ELECTRICAL REVIEW

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Public or Private?

Divergent Ideas at J.E.A. Meeting

THE virtual impossibility of making fair comparisons between public authority and private enterprise operation of electricity supply was emphasised during the debate at last week's meeting of the London & Home Counties J.E.A. This occasion was the presentation of the report of the General Purposes Committee upon the memorandum prepared by the Incorporated Association of Electric Power Companies putting forward proposals for the reorganisation of the electricity supply industry. Figures purporting to prove the lower cost to the domestic consumer of public-authority service were appended to the report. Their accuracy was not challenged, but company representatives contended that overall national statistics did not place the matter in true perspective.

Opportune Comparison

Mr. W. N. C. Clinch, of the Northmet Power Co., made a sly dig at the Authority itself by pointing out that the average price which it charged for lighting, heating and cooking was 1·76d. per kWh, while the Northmet price was only 1·44d. This rather wide difference (about a third of a penny) was claimed by Alderman W. H. Shaw to be due to the higher price which the Authority had to pay for purchased energy.

Major H. Richardson (Metropolitan Electric Supply Co.) again pressed the point that as a rule the companies had been left with thinly-populated areas in which the local authorities were not interested. He quoted as an example of the differences in charges necessitated by differences in population density the case of the Cardiff areas, city and rural, in which two local authorities were concerned.

It seems that the debate merely confirmed two things. First, that a fair comparison between company and municipal operation could only be made in two exactly similar areas and we do not suppose that such exist. Secondly, that the conflict of "ideologies" persists: that those who advocate public ownership and others who see disadvantages in it will apparently never be able to reconcile their views.

Can the Public Decide?

Mr. I. J. Hayward said that there *must* be cleavage between the two parties. It was for the public, having been informed, to decide which form should be adopted.

In this matter the public has been informed so much and by so many conflicting interests that it must be in a state of bewilderment, and, in any event, as a whole it is totally unable to decide whether public or private ownership of any particular industry or service is better. The question is ultimately a purely political one: whether public ownership is to be the *general* policy of the country or whether private enterprise is still to be allowed to operate. Public opinion will be formed by the two principal political parties which, broadly speaking, represent the two sides of the argument. Not all those who advocate the taking-over of public utilities would subscribe to the doctrine of State ownership of all the means of production

and distribution of goods and services ; they should see that the distinction between " public utility " and other vital services is in many directions a very fine one.

Fuel Saving

LAST week we drew attention to the reduction in the consumption of electricity for lighting, heating and cooking that occurred in 1942/43 as compared with the previous twelve months. This voluntary rationing on the part of consumers saved more coal than might appear at first glance, the extent of the economy being quite disproportionate to the number of kWh involved. The reason for this is that the amount of the fuel saved through non-use of apparatus varies in accordance with the time of day when the reduction is made, reaching its maximum during peaks. The advantage of keeping off the peaks in the fuel economy aspect is probably less widely appreciated than it is in regard to capital and other standing charges.

Incremental Loading

UNDER grid operation the base load of the country is carried by the most efficient stations. In the morning, as the load rises, additional generating plant is brought into use in the order that corresponds most nearly to its thermal efficiency. The least efficient plant which carries, broadly speaking, the less essential load is thus employed last of all and it is also taken out of service first. Thus the saving corresponds to the coal burned per kWh in the oldest stations connected to the grid. The Commissioners' pre-war Fuel Returns indicate that this might be appreciably more than twice that of the more modern stations and there is every reason to suppose that wartime operation has increased the difference between the two classes.

Industrial Research

JUST as the electrical industry was the first to adopt the successful form of organisation in which a whole industry, in co-operation with the Department of Scientific and Industrial Research, looks after investigations into matters of common interest leaving problems of more individual concern to manufacturers' laboratories, so it may once more give a lead in meeting the needs of the post-war stage of development. In a recent letter to *The Times* the President of the Institution of Electrical Engineers, Sir Stanley Angwin, drew attention to the Institution's recent report, which envisaged the setting up of a board consisting of scientific representatives of research bodies which would co-ordinate all research activities in the electrical industry, including the publication of results and the training of the requisite personnel.

A Good Record

FEW men have devoted so much unpaid service to the progress and well-being of the electricity supply industry as Alderman William Walker, whose retirement from the Central Electricity Board is announced. Although he has been a representative of the employers on the various bodies dealing with conditions and remuneration in the industry, it can safely be said that the employees' sides of these bodies have had no more powerful advocate than Alderman Walker. In the development of electricity he has been equally active in his connections with E.D.A. and the I.M.E.A. but, more particularly, as a member of the Central Board which he and his colleagues have made a firm and successful national institution.

The late Mr. J. Rowan

THE announcement of Alderman Walker's retirement from the Central Board came at about the same time as news of the death of Mr. James Rowan who was for over forty years associated with the Electrical Trades Union—for the last thirty-four as general secretary. He was Alderman Walker's " opposite number " in the formation and running of the National and District Joint Industrial Councils for the Electricity Supply Industry and shared with him the credit for the successful operation of this organisation. Mr. Rowan did much to secure for electricians the status and wages commensurate with the importance of their job and both they and the electrical industry generally have benefited from his work.

E.D.A. Looks Forward

THE decision of the British Electrical Development Association to fix this year's subscription at the full normal rate is an indication that the Association intends to be ready for the " big push " which must come as soon as possible when the war ends. Only half of the amount is being asked for now; the other half will be treated as a reserve to

draw upon to the extent required. If they are to be quick off the mark after the war supply undertakings will have to call upon the specialised services of E.D.A. They should accordingly welcome the Association's decision to be fully prepared to give them all possible aid.

On the Rates

OFTEN have we complained when local authorities have taken part of the surplus of their electricity undertakings for the relief of the rates. But we feel just as badly about the reverse process—not because it is not generally justified but because it indicates that all is not well with the undertaking. Such is the case at Stoke Newington where it is proposed to transfer an adverse balance to the general rate fund. The ratepayers cannot complain, for in previous years the fund has received more from the Electricity Department than the deficit which it is proposed to transfer. The position at Stoke Newington, which is due to a steadily rising cost of bulk supply without a compensating increase in selling prices, is not unique we fear, but so far little has been done about it by the Government.

Conduit Joints

EVERY case of high earth conductivity in screwed- or grip-conduit systems investigated by the Electrical Research Association in preparing its recent Technical Report F/T 152A (2s. net) is traceable to defective workmanship. Deficiencies include the use of worn dies and imperfections in the enamel and overall painting as well as in faulty assembly. Tests relating to both indoor and outdoor installations (some of the latter in normal service) covered the effects of abnormal humidity, contact with wet cement and mechanical stresses. The extent to which deterioration may occur, even with good workmanship, is not yet clear; this is to form the subject of further researches and recommendations, but in the meantime the present Report will be found to repay careful study on its own account.

Installation Fittings

A FREQUENT cause of poor conductivity is to be found in looping-in boxes, largely on account of difficulty in tightening the bushes, especially where there are three or more back outlets, since space is restricted and a suitable tool is lacking. A suggestion made in the E.R.A. Report referred to above is that a copper sheet, bored with holes to suit the outlets, should be placed between the male bushes and the inside surface of the box. Similar trouble regarding continuity arises with adaptable boxes embodying female brass bushes and lock-nuts, and the use of male bushes and plain couplers is strongly recommended.

A Rural Example

To counteract the false impression likely to be derived from some public speeches that electricity is practically unknown in the rural areas of this country, we have published a number of articles showing how much has actually been done to bring the benefits of electricity to farmers and country dwellers. The latest of these is the one on the Mid-Cheshire area printed in this issue. In this case two-thirds of the farms in the company's 160 square miles are using electricity to an increasing extent. A notable feature of the Mid-Cheshire system is the relatively small proportion of low-voltage mains to higher-voltage lines. A 33-kV "backbone" has numerous 6·6-kV spurs which are tapped for transformers at 700 points. If necessary the 33-kV ring is tapped direct; there are seventeen points at which this has been done.

Efficiency and Economy

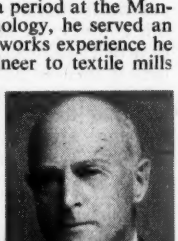
IT is a curious fact that those who are keenest upon securing economy in fuel consumption are often in the least favourable (from this aspect) position to do much. This is because they had already realised the value of proper utilisation of fuel to any undertaking, not only from the expense point of view. The reason why the Southern Railway has been unable to reduce its energy consumption per car-mile is that from the start of its electric services it aimed at maximum efficiency. Nevertheless it is saving 80,000 tons of coal per year (23 per cent.) by a drastic reduction of the services. In electrical terms the saving is 121 million kWh, the present consumption being 409 million kWh. As regards economy in heating, many passengers who have suffered will agree that "it is inexpedient to carry this kind of economy too far, since too drastic lowering of the standard of travelling comfort may impair public health."

Central Board Change

Sir Percival Bower to Succeed Alderman Walker

UPON the expiry of his present term as a member of the Central Electricity Board, Alderman William Walker is leaving the Board. His place is to be taken by Alderman Sir Percival Bower, of Birmingham.

Alderman Walker has a long record of public service, particularly in relation to the electricity supply industry. He is an engineer and a member of the Institutions of Electrical and Mechanical Engineers. Following technical education, including a period at the Manchester College of Technology, he served an apprenticeship and after works experience he became an advising engineer to textile mills and chemical works. Subsequently he joined Henry Simon, Ltd., the Manchester engineers, and associated companies, becoming a director in 1919.



Alderman W. Walker

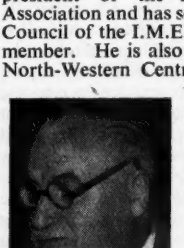
His municipal service commenced in 1907 as a member of the Gorton U.D.C. When that district became a part of Manchester in 1909 he was made an alderman of the City Council. He immediately joined the Electricity Committee and for over twenty years was deputy-chairman and chairman. In 1932-33 he was elected Lord Mayor of Manchester.

From the beginning of his public career, however, Alderman Walker has had more than a "parochial" outlook. Particularly in the quest of reasonable remuneration for the employees of the electricity supply industry has he been active. When the National and District Joint Industrial Councils were established, largely through his influence, he was elected the first national chairman and was maintained in that office for a number of years in spite of the fact that the constitution provided that the chair should alternate between the employers' and the workers' sides.

Since then he has been re-appointed chairman on numerous occasions and has remained chairman of the employers' side from the beginning in 1919. When, in the same year, the National and District Joint Boards for the Electricity Supply Industry were set up he became the first chairman of the National Board and has held that office continuously ever since.

In 1921, mainly through his efforts, a method of remuneration for chief engineers of supply undertakings—the "Walker Scale"—was formulated and just before the war this was placed on a firmer basis by the formation of National and District Joint Committees of Local Authorities and Chief Electrical Engineers.

Alderman Walker was one of the original members of the Central Board, which was set up in 1927. He has also served the industry in many other directions. He is a past president of the Electrical Development Association and has served many terms on the Council of the I.M.E.A. of which he is still a member. He is also a past-chairman of the North-Western Centre of the I.E.E., and a past-president of the Engineers' Club, Manchester. He is a member of the Council of Victoria University, Manchester, and has travelled extensively in many parts of the world.



Sir Percival Bower

Alderman Sir Percival Bower has also been prominent in public life for many years. He was born at Hythe, Kent, in 1880, and entered upon an engineering career. At an early stage he become known as an able negotiator in engineering matters and during the last war held many positions of an advisory character in connection with the production of munitions, the training of disabled Service men and other matters.

He was elected to the Birmingham City Council in 1919 and in the following year was appointed an alderman and magistrate. Four years later he became Lord Mayor. He was made an M.B.E. in 1920, in 1926 was appointed a Chevalier of the French Legion d'Honneur, and was knighted in 1927. During his association with the Birmingham City Council he has been active on many committees, particularly the Electric Supply Committee, of which he was chairman for thirteen years, and he has been prominent in the counsels of the I.M.E.A. He is also a past-president of E.D.A. and his work as chairman of the General Purposes Committee of the Association of Municipal Corporations is well known.

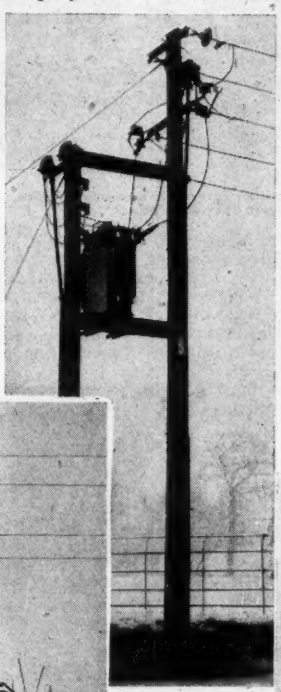
Sir Percival has been a member of many Commissions and Committees, including the Chelmsford Committee on the British Industries Fair in which Birmingham, of course, has a very special interest. His industrial connections cover a wide and varied field.

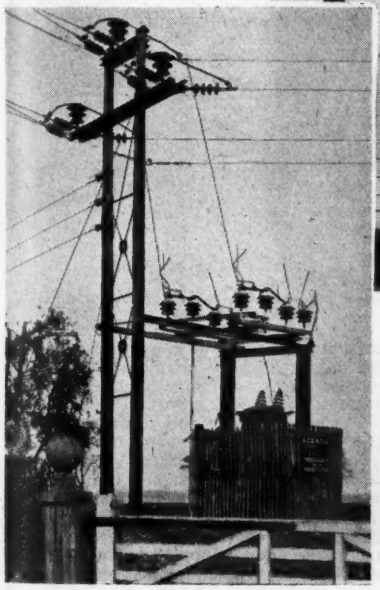
Progress in Mid-Cheshire

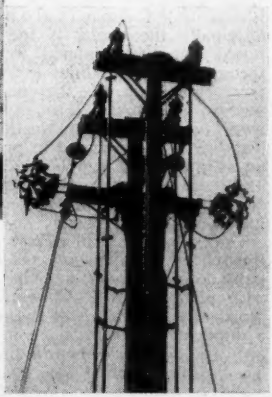
Electrification of an Extensive Rural Area

SINCE the Mid-Cheshire Electricity Supply Co., Ltd., holds the proud position of serving one of the most highly electrified rural areas in the country—66 per cent. of the farms in its 160 sq. mile area use electricity, compared with an average of under 10 per cent. for the whole country—the methods the company has adopted to achieve its results are especially worth studying at the present time when the future of rural communities is so much to the fore. The way in which the development of the Mid-Cheshire extension of the Northwich undertaking first began is in itself interesting, reflecting as it does the factors which have been conspicuous through the whole of the company's post-1918 history — foresight, enterprise and, perhaps above all, the characteristic of the company's general manager and engineer, Mr. W. Fennell, not to allow progress to be held up indefinitely by out-of-date regulations or technical methods.

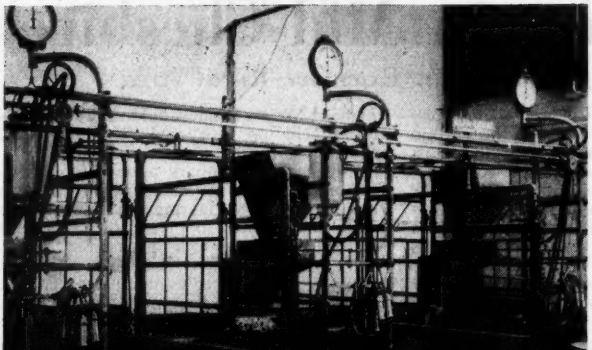
The chance to embark upon rural electrification came to the company in rather a roundabout way. During the last war the small undertaking supplying the village of Weaverham, about four miles from Northwich, got into difficulties and eventually asked the Northwich Electricity Supply Co., as the Mid-Cheshire Co. was then called, to take over the supply. In the new Special Order needed to transfer the Weaverham Order it was decided to include almost all the unoccupied area between Northwich and the neighbouring undertakings, including the small towns (urban districts) of Knutsford, Winsford and Middlewich, even though at that time there appeared to be little likelihood of the company's being in a position to take supplies so far afield in the time limit of three years which the Order specified in the case of each of the three towns. Despite various delays in securing the approval of the several local authorities involved the







Above: Typical overhead line—6·6-kV, three-phase (one phase earthed) — with 50-kVA transformer providing l.v. single-phase supply
Left: 33-kV main line tapped en route to supply the village of Bostock which does not exceed twenty houses
Right: 6·6-kV line with auto-reclose switching units



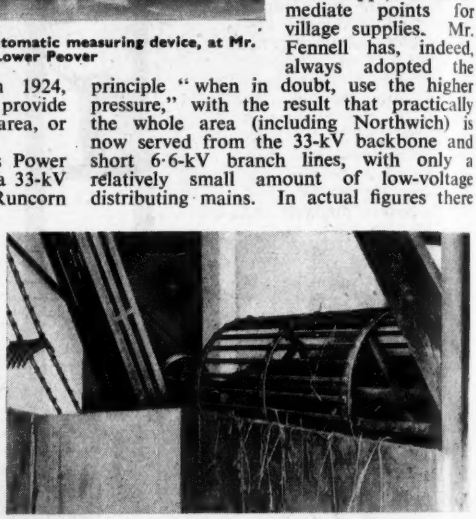
A multiple milking machine, with an automatic measuring device, at Mr. Haworth's farm at Lower Peover

Order was eventually granted in 1924, and it became necessary either to provide a new power station for the whole area, or to obtain a bulk supply.

The decision of the North Wales Power Co. later in the same year to erect a 33-kV overhead transmission line between Runcorn and Crewe for the purpose of supplying the eastern end of the North Wales Electricity District, until it could provide a supply from its system in Wales, provided a solution acceptable to the Electricity Commissioners. Originally the route of the proposed line was planned to pass through Oakmere about five miles from Northwich, but the company secured its diversion through Hartford, two miles from Northwich. The line was duplicated to provide an adequate bulk supply to Crewe, and there was sufficient margin for Mid-Cheshire's anticipated requirements for several years.

Once having embarked upon this scheme of expansion, the company decided almost immediately to proceed with plans for a 33-kV ring main around Northwich at a radius of about 1½ miles with a duplicate extension from it to Knutsford, and another to Winsford and Middlewich. The whole scheme was completed within eighteen months and supplies commenced simultaneously in the three "new" towns on August 17th, 1928, well within the time limit allowed by the Order for each urban district. It may interest readers to know that the record of the company since 1919 was such that the necessary capital (£100,000) for the initial main lay-out to reach and supply the three towns was obtained by a public issue in 1924, and that the shareholders themselves have taken up several further issues (to a total of about £760,000) and there has been no need to go to the public again.

The adoption of a pressure of 33 kV for these lines was in those days a revolutionary departure from normal practice, which regarded 11 kV as the maximum for main distribution lines intended to be tapped at intermediate points for village supplies. Mr. Fennell has, indeed, always adopted the principle "when in doubt, use the higher pressure," with the result that practically the whole area (including Northwich) is now served from the 33-kV backbone and short 6·6-kV branch lines, with only a relatively small amount of low-voltage distributing mains. In actual figures there are approximately thirty-one miles of 33-kV, 243 miles of 6·6 kV, and 175 miles of low-voltage mains, including underground distribution in the four towns.



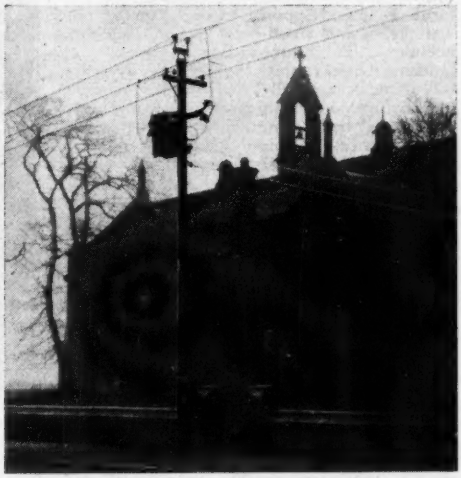
A root cleaner and elevator installed at Mr. W. R. Chown's farm at High Legh

The advantage of this arrangement of a 33-kV main lay-out, with 6·6-kV spurs, is, of course, that no matter at what point the load develops the company is in a position to supply all demands within reason without any special provision being made for transmission. All that is necessary is to tap the line at the desired spot, erect a transformer, almost always pole-mounted, and run off

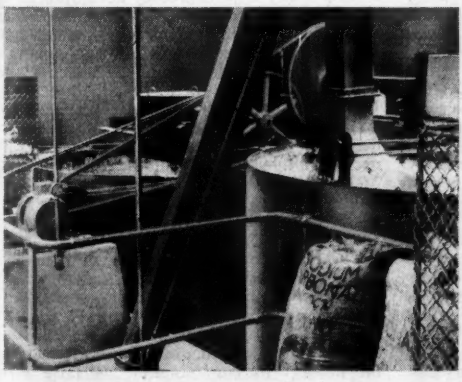
the small low-voltage main needed. Actually, about 700 of these transformer points have so far been provided. To avoid the usual grievance of those living near main lines, an inexpensive form of tapping of 33-kV lines has been adopted, and has been in use for over fifteen years. There are seventeen of these tapping points now in operation supplying villages, etc., in their neighbourhood and one of them is illustrated.

To reduce distribution costs another unorthodox device pioneered in Mid-Cheshire has been adopted on the 6·6-kV rural system. Instead of earthing the neutral of the three-phase branch lines, one of the phases is earthed instead. This has the advantage of permitting the use of double-pole switching and fusing on a three-phase system and single-pole on the single-phase branches which have been extensively used in the "truly-rural" areas. Moreover, the disadvantages of unattended high-voltage fused tappings have been reduced during the last few years by the use of an auto-reclosing switch-fuse which, in conjunction with Johnson & Phillips, Ltd., one of the members of the company's staff has developed. The 65 per cent. successful reclosures achieved on one alternative fuse is of great value in these days of staff shortage. Yet another way of saving expense in overhead-line work has been the use of "compound" lines in which one line of poles takes both high-voltage and low-voltage circuits, an arrangement looked on with some degree of apprehension in early days when it was pioneered in Mid-Cheshire. It is now employed by a number of undertakings, and is recognised as the best means of dealing with ribbon built villages, which are prevalent in some parts of the country.

It is probable that if the orthodox method of three-phase high-voltage branches, relatively large transformers, and extensive and therefore heavy and expensive four-wire low-voltage distribution had been adopted at the outset, rural extensions would have been confined for many years, as in most areas, to large villages and those near the high-voltage lines supplying them. It has, however, been the policy of the company to give supplies in the shortest possible time to the people who want them most, wherever they may be. For this reason development has not been on a pre-arranged programme, in blocks, but in almost any part of the area as the demand has become apparent.



A 10-kVA transformer provided to serve an outlying school at Delamere—one of many where mid-day meals are provided



Brine purification tanks operated electrically at the New Cheshire Salt Works

The methods adopted, before the war, to publicise electricity in a "prospective" area included the use of a travelling demonstration caravan connected to the nearest point of existing supply. Demonstrations of cooking, water heating, etc., were carried on for a week or so in that village, and canvassing at the same time in the prospective nearby area was also used to publicise the demonstrations and make known the company's offer to wire installations of a few points on simple hire. All this activity has, of course, ceased for the duration of the war, but there are still wartime cooking demonstra-

tions, etc., at the company's showrooms at Northwich, which is Mid-Cheshire's bus centre, while an up-to-date new showroom completed at Knutsford soon after the outbreak of hostilities will be available for cooking and other demonstrations when development work is resumed.

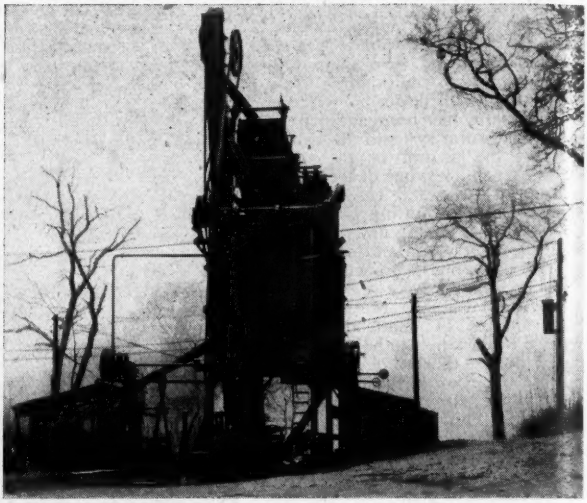
The fixed charge of the two-part domestic tariff is based upon wattage of lamp connections in three grades; living rooms, full price; occasionally used living rooms, half price; and bedrooms, quarter price. This is a relic of the past when lighting produced the peak, but it will survive until a new national standard is adopted because it has succeeded in bringing 97 per cent. of the lighting and domestic sales on to this tariff.

Rarely, if ever, are consumers asked for a cash contribution towards the cost of mains to provide a supply, but they may be asked to guarantee a certain annual revenue, usually equivalent to 20 per cent. of the cost of the line and transformer, or in the case of a joint application each applicant is required to guarantee an annual revenue of not less than 20 per cent. of the rateable value of his premises, and the total guaranteee should reach 20 per cent. of the capital outlay for the extension, to cover not only mains but service lines to supply the original guarantors.

Those consumers who come on later, *i.e.*, after the construction gang has left, are charged a standard amount (about £4) for each pole required for their own service line. Knowledge of this induces any who are hesitating to join in the guarantee and secure a "free" service line. The company also secures the largest possible number of consumers from the commencement, which is a matter of importance.

Where a consumer's account falls short of the guarantee, only half the deficiency is charged on the ground that this covers the capital charges, while the other half is allocated to the prime cost of electrical energy which has not been used. This concession is much appreciated by farmers, most of whom work in quite a small way and certainly required pre-war any surplus money they had for purchasing farming appliances.

It also encourages them to make a liberal estimate of their possible usage, where guarantees are required to justify an extension. Domestic apparatus—cookers, wash-boilers, kettles and circulators—are invariably hired,



Electrically operated gravel and sand screening and washing plant at Delamere

while hire-purchase facilities are available for sterilisers and other equipment. An active servicing organisation is maintained in both town and country.

A Paying Scheme

Having adopted the methods we have described the company has not only achieved a remarkably high degree of development in a surprisingly short time but has also made the Mid-Cheshire extension scheme pay since its inception. In 1939 the company's high-voltage mains had reached the boundaries of the area in all directions. There are no fewer than 17,300 premises taking supplies out of a total of 24,700 in the area, and the domestic appliances connected (almost all on simple hire) include 2,735 cookers, 6,197 grillers (one cooker or grill for each two domestic consumers), 1,427 water heaters and wash-boilers, and 3,080 kettles.

The large number of grillers, or breakfast cookers as they are sometimes called, which have been installed (2s. 6d. a quarter, including maintenance) is particularly remarkable and is evidence of a singularly successful campaign to introduce electric cooking into the home "by easy stages." A large proportion of consumers now using electric cookers made their first acquaintance with

electric cooking by the employment of a griller.

As we have already indicated the company, despite the fact that the agricultural load is not a particularly remunerative one, has gone out of its way to enable farmers, especially the smaller ones, to use electricity to the full. Of the 1,100 farms in the area (a "farm" is taken to be any agricultural holding of over one acre) 738 (67 per cent.) are now connected. Owing to the small size of the farms and to the extremely conservative outlook of most of the farmers, they cannot as a whole be yet considered highly electrified, but the applications to which electricity is put are very varied.

Many Applications

Besides milking, utensil sterilising, bottle washing and refrigeration, such duties as milling, chaff cutting, root chopping, grass drying and pumping are carried out electrically. On dairy farms of any size it is now the exception for milking not to be done by electricity, while almost every farmer's wife finds her domestic duties much simplified by having her home "all-electric." Not only are the needs of the farmers themselves studied but also those of the farm-working community as a whole. A surprisingly large number of farm workers have been encouraged by "hired wiring" to have electricity in their homes and recently the company has been equipping the local quota of new rural cottages which the Ministry of Health has allowed the Rural District Council to erect during the war.

The installation in one of four houses being used for demonstrating post-war urban housing schemes comprises a cooker, kettle, 1½-gal. water heater over the sink and 10-gal. wash-boiler with an adequate provision of plugs for radio, fires, vacuum cleaner, etc. In the other three the eventual tenant will make his own choice and arrange to hire what he needs.

The provision of meals for school children, particularly in outlying districts, has been much helped by electrical facilities. At Delamere school, for instance, with the help of an electric cooker (9·8 kW) and a 15-gal. water heater, eighty children are given a daily two-course meal for the cost of only 9s. to 10s. a week for electricity. Actually, during an influx of evacuees, 156 children have been catered for at practically the same cost.

Industrial Load

Domestic and agricultural uses of electricity are not the only ones provided for. Of the various industries which make very good use of the facilities offered them may be mentioned those producing salt, chemicals, ships, textiles, pottery, leather, fertilisers, insecticides, wash gravel and cheese. There is a constructional steel works, a large silk spinning mill and several clothing factories, saw mills, etc. Waterworks too have been largely electrified. Although we may not publish recent statistics, it will give some idea of progress to mention that in the last pre-war year (ended December 31st, 1938) sales of electricity totalled 18 million kWh, which compared with only just over 6½ million kWh in 1933.

When the war put a stop to normal development, the company's system of mains had reached every village and high-voltage spur lines had in many cases reached farms, etc., on the boundaries of the area and the work of connecting farms has continued during the war. What with the accumulation of urban and village demands since 1939 and a policy of not only extending supplies to new consumers, but also of interesting existing consumers in new uses for electricity, the company is likely to be busy for a considerable time after the war.

We should like to thank the company for permitting us to visit its area and also Mr. Fennell, Mr. A. R. Chorlton (consumers' engineer) and Mr. A. C. Eden (mains engineer) for their help in preparing this article.

Discharge Lamp Apparatus

THE Electricity Commissioners have drawn the attention of electricity undertakings to the Discharge Lamp Lighting (Control) No. 1 Order, 1944, which provides, *inter alia*, that no person shall install any discharge lamp lighting apparatus except under the authority of and in accordance with a licence granted by or on behalf of the Minister of Works. They state that in view of the necessity for conserving materials to the maximum possible extent, application for licences should be made only where full justification can be shown on the basis of present war conditions and they assume that, in fact, the number of cases in which undertakings will find it necessary to apply for licences will be comparatively few.

Where, however, an undertaking desires to make such an application, the following procedure should be pursued:—Undertakers desiring to acquire discharge lamp lighting apparatus should submit their application on the prescribed form to the Regional Licensing Officer of the Ministry of Works, from whom copies of the form can be obtained. It will not be necessary for the undertakings to obtain the prior approval of the Commissioners. For certain types of user Regional Officers will be prepared to issue a licence without consultation with the Commissioners.

Where the Regional Licensing Officer feels any doubt on an application submitted by an electricity undertaking, he will communicate direct with the Electricity Commissioners to obtain their observations. If a Regional Licensing Officer refuses any application, it will be open to the undertaking if it wishes to pursue the matter, to refer it to the Commissioners who will consider whether the case is one which they would feel justified in taking up with the Ministry of Works.

Railway Fuel Economy

Conference in London

THE series of conferences that began in London in September of last year when the fuel economy campaign was inaugurated by the Minister of Fuel and Power, continuing monthly in Manchester, Glasgow and Birmingham, concluded in London this week with a discussion over which Mr. V. A. Robertson (civil engineer, Southern Railway) presided. About 130 delegates represented British railways and the London Passenger Transport Board, two papers being presented after luncheon.

Savings on Southern Electric Lines

In the first paper Mr. W. J. A. Sykes (Electrical Department, Southern Railway) points out that the capital cost of conversion from steam to electric traction is as a rule considerable. The ideals of efficiency and economy in working are everywhere expressed from the beginning in the design and methods of operating the electric rolling stock, so that the only saving which is practicable in present circumstances is a quantitative one resulting from less use being made of the available stock.

During the last two pre-war years the car miles run by electric stock on the Southern Railway averaged about 220 million per annum, requiring some 530 million kWh, representing 350,000 tons of coal. Present electric services necessitate the running of some 164 million car miles per annum, consuming 409 million kWh, to produce which about 270,000 tons of coal is needed, an annual saving of 23 per cent.

This saving (apart from heating and lighting economies) is clearly the result of reductions of service alone, since it has been necessary to maintain pre-war schedule speeds; there has therefore not been any appreciable reduction of energy consumption per car mile. The reason is that from the beginning maximum efficiency has been aimed at, both in handling the trains and in the methods of converting electrical to mechanical energy on the trains. The control equipment is designed automatically to produce the correct rate of acceleration, while all runs are well within the capacity of the driving motors so that much coasting is therefore possible normally.

The author emphasises the importance, from the energy-saving point of view, of coasting in conjunction with acceleration and braking considerations. Coasting boards are provided on the track side to indicate to the train drivers the most suitable points at which to switch off power, so that current is on only for some 30 to 50 per cent. of the journey time. Such technical efforts to minimise waste would be of little use without the loyal co-operation of the train drivers, which is especially valuable on the longer non-stop runs where it is not possible to establish fixed coasting marks.

The amount of electricity utilised for heating Southern Railway trains is greater than is realised. The installed full-heat capacity of all the electric stock exceeds 14,000 kW, made up of 36,000 heaters of 300 W and 6,000 of 500 W, besides air conditioning plant in dining and restaurant cars. In the coldest weather the heating load becomes serious; considerable saving may be achieved by curtailing the heating period, but determination of the fuel saved thereby depends on too many variable factors to be exact. An approximate estimate is 5,000 tons per month during which heating is not used, but it is inexpedient to carry this kind of economy too far since too drastic lowering of the standard of travelling comfort may impair public health.

The pre-war standard of illumination was 120 W per compartment, which has been reduced by "black-out" restrictions to one 25-W white lamp and one under-run blue bulb in each compartment. Thus an energy reduction of 70 per cent. in some 2,600 coaches has been effected, forming some 80 per cent. of all the stock in commission, being an overall economy of 56 per cent. in installed capacity. That figure has been reduced to 47 per cent. by popular demand necessitating replacement of the blue bulb by a second 25-W lamp.

Power Station Fuel

In the second paper discussed at the conference Mr. W. A. Worth (chief supplies officer, London Transport) deals with the amount and quality of coal used for locomotives. He explains that fuel for railway power stations is concentrated mainly in vulnerable areas, which fact necessitates the creation of reserve stocks. Inadequacy of bunker capacity for wartime stocks has led to the use of the nearest storage ground, but while a sufficiency to guard against interruption of delivery may thus be accumulated "on paper," it may be quite impossible to lift coal at the rate of its consumption.

The poorer and varying quality of small coal available for generating electricity creates a vicious circle of evils that one cannot fail to be cognisant of, though the problems involved are not capable of being remedied in the present state of the mining industry.

Transformer Protection

The Restricted-Zone Earth-Leakage System

By H. E. Forrest

STABILITY when earth faults occur outside the protected zone comprising a power transformer, its associated current transformers and pilot leads is afforded by the use of the restricted-zone earth-leakage protective system. The method may be applied to either the higher- or lower-voltage side of the transformer, independently of the connection of the winding

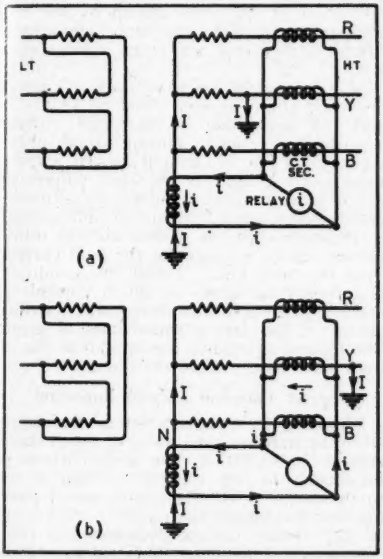


Fig. 1.—Transformer protected on higher-voltage circuits and fed from lower-voltage side; earth faults (a) inside and (b) outside protected zone

on the protected side. Difficulties arise, however, when the transformer windings are connected star-star owing to the presence of harmonic currents.

Fig. 1 shows the current transformers and connections when the high-voltage star-connected side of a transformer is protected. Figs. 1a and 1b show the directions of current flow when the earth fault occurs inside and outside the protected zone. In the first case the relay will operate, but in the other it is non-operative and the system is accordingly stable. In both cases the transformer is supplied from the lower-voltage side.

Consider, as an example, a 30-MVA transformer protected on the 35-kV star-connected high-voltage side. Normal full-load current is 500 A. The relay must operate instantaneously should an earth fault approximately equal to 20 per cent. of normal full-load current occur in the protected zone. At the same time, however, the system must remain stable to through faults, *i.e.* faults occurring outside the protected zone equal to fifteen times normal full-load current or 7,500 A, with possible transient peaks of 2½ times this value or 19,000 A. To meet these conditions a stabilising resistance must be incorporated in the relay circuit to limit the initial transient "kick" in the differential or spill current. As stability, with fixed components, can be obtained only at the expense of sensitivity, a stipulation is made that the inclusion of a stabilising resistance shall not decrease the sensitivity of the circuit (already specified at 20 per cent.) beyond 30 per cent.; *i.e.* an earth-fault current equal to 30 per cent. of normal full-load current shall operate the relay when the latter is adjusted to operate on its 20 per cent. setting.

The only true test of protective gear is its operation under working conditions. As, however, complete tests cannot usually be carried out on site, the components must be thoroughly tested at the manufacturer's works in circuits designed to represent actual conditions as in Fig. 2. The resistances r_1, r_2, etc. are equivalent to the resistances

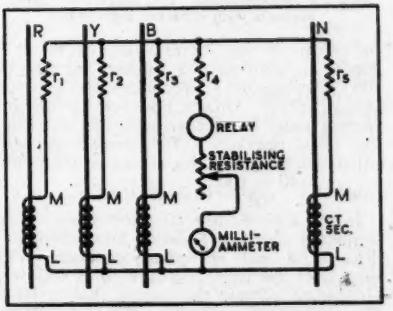


Fig. 2—Test circuit for simulating fault conditions

of the cables between the current transformers when in position on site, M and L indicating polarity. To obtain stability to through faults, the neutral current trans-

former is connected in phase opposition to those in the lines.

A sensitivity test is made by supplying single-phase current to the primary of the neutral current transformer and gradually increasing it until the relay operates. The magnitude of the primary current is noted. In the case of the transformer cited above

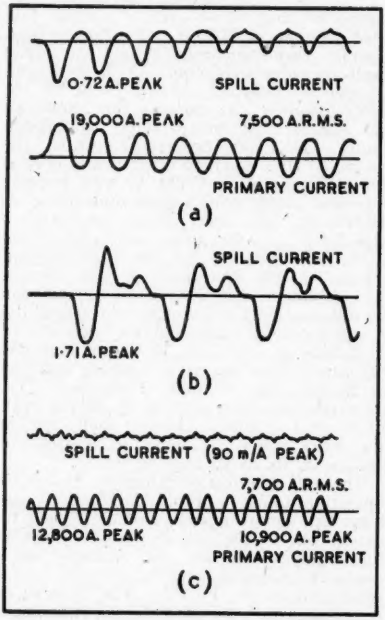


Fig. 3.—Oscillograms for maximum spill currents with different transients

the ratio of the current transformers is 500:5 A. Normally a primary current of 100 A produces a secondary, or tripping current, of 1 A. On test, however, the primary current must be increased to 140 A before the relay operates. The percentage sensitivity of the protective circuit is, therefore, equal to $\frac{140 \times 100}{500}$ or 28 per cent.

In the stability test the earth faults to be simulated are single-phase, phase-to-phase, three-phase and zero-phase-sequence. In each case the test procedure is as follows: Gradually increase the supply current from 500 to 7,500 A. Measure the spill current under this "steady" AC fault condition. With the supply current set at 7,500 A, switch off and then suddenly close the switch again to produce the effect of a transient. This should be repeated several times. In practice it is generally assumed that ten shots will produce at least one high asymmetrical value. This is checked by an oscillograph timed to operate simultaneously with the closing of the circuit-breaker. The magnitude and wave shape of the spill current and the wave shape of the secondary current are recorded on the same oscillogram. The crux of the test is that the relay should not operate when the transient current reaches a peak value of 19,000 A. During this test the source of supply should be such that there is no appreciable rise in voltage when the test load is switched off.

When recording currents by an oscillograph, non-inductive shunts and not current transformers are employed. The latter may give inaccurate results owing to possible saturation of the cores caused by the DC component during transient conditions. Many oscillograms are taken during each test.

In a number of cases the transient current does not attain a peak value of 19,000 A and the magnitude of the spill current accordingly varies. During single-phase faults, as in Fig. 1, the spill current is quite small and is caused by the slight differences which occur in matched current transformers during manufacture. Maximum spill current is obtained when the neutral current transformer acts as a return for the fault current from the three lines. Under this condition it carries three times as much current as the line current transformers and the flux density in the core is three times as great. The three oscillograms reproduced in Fig. 3 were taken during such conditions.

Correct Transient Current Important

From Fig. 3a it appears that at the instant when the transient peak value of the primary current is 19,000 A, the spill current is insufficient to trip the relay which is set to operate at 1 A. The spill-current peak quickly disappears as the DC component in the primary current decreases and conditions revert to steady AC values. It is obvious that the initial peak may trip the relay while the spill current, under steady conditions, is insufficient to do so. It is important therefore to apply the correct transient current. When this oscillogram is obtained a stabilising resistance is incorporated in the circuit.

When exactly the same test is carried out without a stabilising resistance in the circuit the results are as shown in Fig. 3b. In this case the magnitude of the spill current is sufficient to cause the relay to operate. Fig. 3c is taken under similar conditions to 3a and shows the difference in primary and spill currents when the switch is closed at another point of the voltage wave with a different value of residual magnetism in the current transformer core.

A comparison of these two oscillograms shows that, during the stability test, sufficient shots must be applied to ensure that the required transient conditions are obtained. It is the relative core saturation caused by the transient DC component which may lead to false relaying. Such a protective scheme may be stable to gradually increasing primary current and operate immediately when the same current is applied suddenly, as under fault conditions. There is no relationship between the magnitude of the spill currents under steady and transient conditions. In the latter case the magnitude of the initial peak in the spill current can only be recorded by an oscillograph.

J.E.A. and Power Companies

Criticisms to be Passed On

IN last week's issue (p. 19) we published a summary of a report prepared for the London and Home Counties Joint Electricity Authority on the memorandum on reorganisation of the electricity supply industry by the Incorporated Association of Electrical Power Companies. This report, which was mainly inimical to the power companies' proposals, came before the Authority at its monthly meeting on January 6th, when it was decided by 22 votes to four to submit the report to the Ministry of Fuel and Power, other appropriate Ministries and the Electricity Commissioners.

Unsound Comparisons

Mr. W. N. C. Clinch (Northmet Power Co.), criticising the report, maintained that it made comparisons of dissimilar matters. The areas on which the comparisons were based were not similar, for the power companies had much larger areas and fewer consumers per square mile than the local authorities. Moreover, the comparisons were unfair because they did not show properly the " make-up " of the figures purporting to prove that local authorities charged less to domestic consumers than the companies did. The revenue per unit for lighting, heating and cooking was 1·76d. for the Authority and 1·44d. for the Northmet Co. The chairman (Alderman Dudley Stuart) commented that Mr. Clinch had taken only two undertakings ; the report gave figures for the whole country.

Alderman H. E. Goodrich, chairman of the General Purposes Committee, which was responsible for the report, said that in the report an endeavour had been made to cover vast areas in such a way as to make it possible for the consumers in the outlying districts to derive the same benefits as those in the built-up areas. Local authorities represented 80 per cent. of the whole and he claimed that they were the people putting forward the greatest effort to give the population an abundance of electricity at the cheapest possible rate.

The vice-chairman of the Authority, Alderman H. Shaw, said that the figures presented were accurate. In his comparison, Mr. Clinch had not mentioned that the Northmet Co. obtained its electricity from the Central Electricity Board at cost price while the Authority had to pay the grid tariff. The report showed what the motives and intentions of the power companies were and had thus done a great public service.

Major H. Richardson (Metropolitan Electric Supply Co.) said that he did not question the accuracy of the figures given, but they had been carefully chosen to support the attitude taken up in the report and they needed some explanatory notes. Cardiff, with its well-managed Corporation, had an area of 13,600 acres with 240,000 inhabitants. Cardiff Rural Council had taken over the supply of 60,000 acres. The figure for Cardiff Corporation was 1·41d. per unit and that for the equally well-managed R.D.C. was 2·04d. The reason was obvious: they had only 30,000 people in their 60,000 acres.

Fluctuations in the figures for local authorities throughout the country showed how difficult it was to draw conclusions from averages for the whole country. The desire of the Power Companies' Association was to put companies and local authorities on a level basis and then see over a period of years which gave the better service. The public would benefit by co-operative competition by those enterprises. His personal view was that if there was to be a minimum standard of living a spirit of reasonable competition must be maintained. The local authorities had not shown an interest in the development of rural areas but had left them for the companies to develop.

" Must Be a Cleavage "

Mr. I. J. Hayward, vice-chairman of the General Purposes Committee, said that there must be a cleavage between those who stood for public ownership and those who advocated private ownership. It was for the public, knowing the circumstances and having the fullest information, to decide which form of control it desired. Parliament had always anticipated that the electricity supply industry would come under public control. It was well that the public should be interested in this great piece of post-war reconstruction.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AMONG the New Year Honours referred to last week we should have mentioned the name of **Mr. Fred Stewart**, who was created a K.B.E. Mr. Stewart and his brothers founded, in 1901, the Thermotank Company for the production of ventilating and air-conditioning plant for ships. He is also chairman of Kelvin, Bottomley & Baird, Ltd.

As reported in our issue of July 9th last, **Mr. Frank Forrest** is retiring from the position of chief engineer and manager of the Birmingham Electric Supply Department on February 2nd. Arrangements are being made for a luncheon in his honour to be held at the Grand Hotel, Birmingham, on February 4th, when a number of local and well-known electrical personalities are expected to be present.

Mr. P. C. Sharp, secretary, and **Mr. A. P. Quarrell**, London Office manager, have been appointed to the board of Petters, Ltd. Mr. Sharp joined the staff of Petters at Yeovil in 1928, being appointed secretary in 1934. After the fusion of the interests of the company with the Brush Electrical Engineering Co., Ltd., he was transferred to Loughborough, becoming secretary of the Brush Electrical Engineering Co., Ltd., and its subsidiaries. Mr. Quarrell joined the staff of Petters, Ltd., in 1924, and was appointed London manager in 1937. His responsibilities were considerably increased when the London organisations of Brush and Petters were merged in 1939.

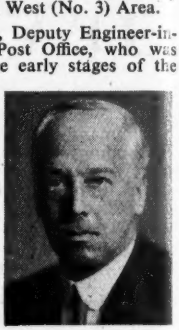
Mr. William Fennell, M.I.E.E., who has been largely responsible for the high degree of rural electrification achieved by the Mid-Cheshir Electricity Co., Ltd., as described in this issue, has been engineer and manager of the undertaking since 1918, and is also a director both o this company and its associate, the Mersey Power Co., Ltd.

Mr. W. Fennell

Mr. Fennell was educated at the Coleshill Grammar School and the Davenant School, London, and received his technical training at the City & Guilds Technical College, Finsbury, where he became senior student and personal assistant to Professor John Perry, and with the Galway Electric Supply Co. In 1896 he became charge engineer to the House-to-House Co., Ltd., Kensington, obtaining the post of assistant to a Westminster consulting engineer the following year. From 1904 to 1914 he held the position of borough electrical engineer of Wednesbury, and then for a year he went to British Insulated Cables, Ltd., as resident engineer, contract department. From 1915 until joining the Mid-Cheshire Co. he served as resident engineer to the Northmet Power Co. for St. Albans and district.

Mr. Fennell was president of the Overhead Lines Association, 1928-29; chairman of the Transmission Section, I.E.E., 1935-36; and chairman of the North-Western Section, I.E.E., 1938-39. He is now a member of the executivi committees of the Provincial Electric Supple Association and the Joint Industrial Council ary Joint Board for the North West (No. 3) Area.

Mr. P. J. Ridd, C.B.E., Deputy Engineer-in-Chief of the General Post Office, who was closely concerned with the early stages of the conversion of London's telephone system to automatic working, has retired after forty-eight years' service. He entered the employ of the National Telephone Company in 1895 and joined the Post Office as executive engineer on the transfer of the company's undertaking in 1912. He was associated with the London Telephone Service from 1907 to 1926, latterly in charge of the City Internal Section. After two years as an assistant staff engineer in the Research Section of the Engineer-in-Chief's Office he returned to London in 1928 as assistant superintending engineer, and following a further period of service as staff engineer at headquarters he became chief regional engineer of the London Telecommunications Region. He was appointed Assistant Engineer-in-Chief in 1936 and Deputy Engineer-in-Chief in 1939.



Mr. P. J. Ridd

Mr. Ridd has represented the Post Office on Committees of the Institution of Electrical Engineers and the British Standards Institution, and he has also acted as British delegate at conferences of the International Electrotechnical Commission and the C.C.I.F.

Mr. J. F. Field, B.Sc., A.M.Inst.C.E., M.I.E.E., deputy engineer and manager to the Edinburgh Corporation Electricity Department, was unanimously recommended by the Public Utilities Committee at its meeting on January 4th as manager of the Department in succession to Mr. J. Eccles, following the latter's recent appointment as city electrical engineer of Liverpool. Mr. Field was not among the applicants for the position.

Mr. Field, who is forty-one, was awarded a special scholarship in Galashiels which took him to the South of Scotland Technical College, and in 1924 he gained the B.Sc. degree with distinction at Edinburgh University, when he was the leading student of his year and was awarded a bursary. He served his student apprenticeship with the British Thomson-Houston Co. at Rugby, subsequently becoming a steam turbine erector, design engineer and contract engineer on turbine sales.

In 1930 he went to America and after some time with the General Electric Co.in Schenectady he joined the Brooklyn Edison Co.'s plant equipment bureau and assisted in the installation of two 160,000-kW sets and five

130,000-lb.-per-hr. boilers in Hudson Avenue. On his return to England he carried out a large factory reconstruction work for the Calico Printers' Association, Manchester. From September, 1933, to December, 1940, when he went to Edinburgh, he was assistant engineer to the Central Electricity Board, London, and was engaged in administration, planning and plant extension work.

Mr. Field has contributed articles to electrical engineering journals and has delivered papers to various institutions. He was awarded a Telford Premium by the Institution of Civil Engineers for a paper on "Standard Steam Cycles" in 1938, and he is to open an informal discussion in London next April on a paper entitled "Fuel and Mechanical Power."

The Liverpool Electric Power and Lighting Committee has retained the services of **Mr. P. J. Robinson,** city electrical engineer, up to March 31st. As readers are aware, he is being succeeded by Mr. J. Eccles of Edinburgh.

Mr. H. F. Shanahan, borough electrical engineer of Blackpool, who was due to retire under the age limit in March, is to remain in office for a further twelve months.

Blackpool Corporation Electricity Committee is recommending the Town Council to increase the salary of **Mr. E. Donoghue,** power station superintendent, from £500 to £550, plus cost of living bonus, and that of **Mr. W. J. Haslam,** mains superintendent, from £525 to £629.

Mr. A. N. Aikman, B.Sc., A.M.I.E.E., has been appointed chief assistant engineer in the Bradford Electricity Department. For the past fifteen years he has held the position of electrical constructional engineer and substations superintendent in the Department. Mr. Aikman had previously served with Siemens Bros., the Victoria Falls & Transvaal Power Co. and the British Thomson-Houston Co., Ltd.

Mr. E. Lunn, on reaching the age limit, has retired from the position of borough electrical engineer of Huddersfield. He has been succeeded as from January 1st, by **Mr. F. A. Ellis,** A.M.I.E.E. Mr. Lunn is being retained for certain special work for a while.

Mr. Ellis is a son of Mr. Arthur Ellis, M.B.E., M.I.E.E., of Cardiff, and has been deputy borough electrical engineer at Huddersfield since 1939.

Mr. H. Clarkson, of Leeds, has been appointed North East England sales representative to the General Cable Manufacturing Co., Ltd., Leatherhead. He has been connected with electrical interests in the area for over thirty years.

Sir Francis Joseph, Bt., K.B.E., has been elected president of the Institute of Industrial Administration in succession to Viscount Davidson.

It has been decided to revive the "Philips Ball" which was held annually in Bristol with so much success before the war. The function will take place on January 21st, at the Victoria Rooms, Clifton, any profits going to the Duke of Gloucester's Red Cross & St. John Fund. Dance bands are being provided by the Royal Artillery and the Royal Corps of Signals, and there will be non-stop dancing from 7 to 11 p.m. with a licensed bar and refreshments available. Tickets, obtainable from Philips Lamps, Ltd., 86, Redcliffe Street, Bristol, are priced at 6s. single and 10s. double, with a reduction for H.M. and Allied Forces in uniform.

Mr. C. E. Morgan, manager of the Leeds telephone area, retired at the end of December after forty-three years' service with the Post Office. His successor is **Mr. N. F. Sephton,** formerly of Lincoln.

Mr. S. E. Goodall, M.Sc., M.I.E.E., has been appointed as assistant chief engineer to W. T. Henley's Telegraph Works Co., Ltd. He took up his appointment on January 1st.

Mr. W. O. J. Urry, who has been secretary to Heenan & Froude, Ltd., for over twenty years, has been elected a director of that company's two subsidiaries, Fielding & Platt, Ltd., and Court Works, Ltd.

Mr. E. Hugh Armitage has been appointed a director of Murex, Ltd. He is chairman of the Hoffmann Manufacturing Co., Ltd., and managing director of Brown Bayley's Steel Works, Ltd.

On January 4th, the Dramatic Section of Callender's Cable and Construction Co.'s Belvedere Works, gave a performance of "Further Outlook Unsettled" to a packed and appreciative audience of troops in the Royal Artillery Theatre, Woolwich. This amusing farce had previously been presented in October, at Brook Street Schools, Erith, under the auspices of the Erith Theatre Guild, as a result of which a large profit was shared by several deserving charities.

On the retirement from business of **Mr. J. Stinton Jones,** M.I.Mech.E., M.I.E.E., chartered consulting engineer, of J. Stinton Jones and Partners, **Mr. W. Gillam,** consulting engineer, 7-9, Baker Street, London, W.1, has acquired the business and will continue to operate it under its old title.

Mr. Norman Iles has been appointed Director of Plant Progress in the Iron and Steel Control. He succeeds **Mr. Frank Parr** who has been appointed to the post of Steel Commissioner by the Government of India.

Obituary

Mr. J. Rowan.—We regret to record the death, at Flixton, Manchester, on January 5th, of Mr. James Rowan, former general secretary of the Electrical Trades Union. Mr. Rowan, who was about seventy-two years of age, joined the E.T.U. in 1897; he was elected secretary of the Manchester and Salford branch in 1898 and in 1904 he became national organiser. He was appointed general secretary in 1907 and retired in 1941.

The late Mr. J. Rowan

During his long association with the union he was responsible in a large measure for raising it to the strong position which it now holds. Particular reference should be made to his work in the establishment and operation of the National Joint Industrial Councils for the Electricity

Supply, Electrical Contracting and Cable Making Industries. In 1939 Mr. Rowan contributed an article on his union to our series "Organisations of the Industry." In this he claimed that the E.T.U. had played a useful and honourable part in the development of the electrical industry.

Apart from his electrical connections Mr. Rowan played an important part in general trade union activities and was a member of the Trades Union Congress General Council for many years.

Mr. J. M. G. Trezise.—The death has occurred of Mr. John M. G. Trezise, who was for many years Metropolitan engineer to the General Post Office in charge of the G.P.O. power stations. Mr. Trezise was born at Redruth, Cornwall, in 1866, and was educated at King's College, London. He was a member of the Institution of Electrical Engineers.

Mrs. F. W. Lacey.—The death occurred at Bournemouth on January 2nd of Mrs. Louisa Lacey, wife of the late Mr. F. W. Lacey, F.R.I.B.A., M.Inst.C.E., M.I.E.E. She was eighty-five.

Mr. H. Gilpin.—The death is reported of Mr. Harold Gilpin, chief inspector of Post Office Telephones at Southampton.

The late Mr. S. R. Windle

Mr. S. R. Windle.—We regret to learn of the death of Mr. Sydney Robert Windle, who last year retired from the position of chief engineer of the Grimsby Corporation Electricity Department, which he had held since 1928. Previously he had been for ten years chief assistant at Sunderland and then borough electrical engineer of Doncaster for eight years, during which time important plant extensions were carried out. Mr. Windle was a member of the Institutions of Electrical and Mechanical Engineers. He was in his sixty-sixth year.

Lamps for the Services

Great Quantities of Many Types

IN a recent lecture to the Association of Supervising Electrical Engineers in London, Mr. W. J. Jones (director, E.L.M.A.) pointed out that, of the 11,000 lamp types from which the general public could choose before the war about 9,000 have had to be discontinued because of the enormous demand for special Service lamps; even so the supply of lamps for normal purposes compares favourably with that of other articles that used to be regarded by the public as commonplace.

Most of the special lamps required by the Services have to be made by hand, often because very accurate positioning of the filament is necessary for focusing, and the numbers required are very large indeed. For instance, one large night bomber carries over a hundred lamps of different types for signalling, navigation, identification, undercarriage position indication, cockpit and instrument panel illumination, besides others which must not be specified. Also among aerodrome lamps many of the landing floodlight lamps, up to 3 kW in size, must have special pre-focus caps as the narrow margins allowed in standard lampholders would cause excessive variation of beam direction.

Naval Needs

The Navy also uses a great variety of lamps, each corvette needing 420 with 800 spares and each battleship about 14,000. In addition, special signalling lamps in great variety are used, some of them with extremely accurately focused filaments, necessitating a complicated lamp cap machined to very fine limits. Shortage of flash-lamp bulbs and batteries is accounted for by the quantities needed for attachment to lifebuoys, rafts and life jackets.

Lamps employed by the Army are not so varied, but are demanded in great quantities; every tank has about 16 and every lorry about six to which must be added those used for signalling and special lamps mounted on many guns. Cinema films play a big part in Army training and they need lamps, not only for taking the pictures and projecting them, but also for sound recording.

Future of Fluorescent Lamps

With regard to the future of fluorescent lighting, Mr. Jones is confident that lamps of different sizes and various colours will be produced in due course; when available this kind of illumination will "sweep the board" because it is ideally suited to incorporation in built-in schemes, having both artistic and utilitarian merit.

A useful summary in the form of a table indicating the salient features of the part lighting should play in the post-war reconstruction of schools, offices and homes was included in the lecture. More efficient lamps will be produced and better fittings made, but progress will depend upon the facilities provided for their use. It will be necessary to have one standard size of plug, one standard voltage throughout the country, and a greater measure of uniformity in methods of charging for electricity.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Nationalisation

From Sir Herbert G. Williams, M.P.

I FRANKLY do not understand the attitude taken up by my friend Mr. Higgs in his letter published in the *Electrical Review* dated January 7th.

The price of electricity to the consumer consists of two elements: the cost of production, and the cost of distribution, and the latter is by far the heavier part of the charge. The cost of distribution, in part, depends upon the distance of transmission, and partly upon the geographical density of the consumers.

The cost of a telephone call is built up of the centralised costs, that is to say, the cost represented by the expense of the telephone exchange, and the cost represented by the distribution network, and accordingly the longer the distance the higher the charge.

Mr. Higgs suggests that if electricity is nationalised, then we shall have a flat rate of charge, irrespective of distance. To that I would point out that this is not what the State practises in connection with the telephone, and since both the telephone and electricity supply come into our houses from central stations along wires, there is a very close analogy. As the nationalised telephone has approximately doubled its charges over the same period that the charges for electrical energy have been halved, there seems rather a good analogy that would indicate that we get better services from a combination of private and municipal enterprise in electricity supply than we are likely to get from a nationalised electricity supply system.

In any event it is Parliament which has made it illegal to charge some consumers more in order that others may buy it cheaper than otherwise would be the case.

Westminster. HERBERT G. WILLIAMS.

Domestic Ring Main

THE assumption made by Mr. Jacobi in his article in your issue of December 31st that the domestic ring main is to some degree on the way to general acceptance is rather premature. Definite proof will be required that this system is more economical and will provide the same degree of reliability and safety as alternative methods.

Whilst there will be general agreement that one size of socket should be used throughout a domestic installation, his proposal to restrict this to 10 A is one with which I am sure many will not agree. The suggested limitation of the 3-kW fire to the fixed type is surely a retrograde step, as it will obviously discourage the use of this system of domestic heating in rooms requiring 3 kW of heat during cold periods, where such was not provided in the initial stages. Few people will be prepared to go to the trouble or expense of having a 3-kW electric fire fitted and connected when a 2-kW portable fire is obtainable as an alternative. This will lead to dissatisfaction with electric heating.

The author's figure of 11·5 per cent. surely indicates that there was a reasonable demand for 3-kW fires before the war, and this percentage will doubtless increase. It has been suggested that by the use of an adequate number of sockets a 2-kW fire could be supplemented by other fires. This, I contend, would increase the fire risk in the home. The obvious and only place for an electric fire, particularly where small children are present, is the fireplace or a definitely allotted position.

This proposal for a new type and size of socket and fused plug will not be very welcome, particularly as the many attempts at standardisation are showing promising results. Fuse discrimination on the lines suggested will not, in my opinion, be satisfactory in practice. It will complicate a situation which we should endeavour to simplify. There will be nothing to prevent a 10-A fuse being inserted in the plug connected to an appliance requiring say 1-A protection, or *vice versa*, resulting in either a false sense of security or annoyance to the user, to say nothing of those cases where replacement fuses are not readily available. I submit that the existing 15-A three-pin outlet which can, if required, be of the unobtrusive flush type has already proved itself, and should be adopted as the post-war standard.

Instead of the ring main I would suggest the running of a 15-A circuit to each room to feed the required number of 15-A socket outlets on the reasonable assumption that the maximum load will never exceed that figure. A suitable type of 15-A fuse would provide the necessary degree of protection for small appliances which could be fitted with flexible of not less than 23/·0076. The supplying of three or four 5-A sockets by a 15-A circuit is already permitted by the I.E.E. Regulations, and many thousands of outlets have been installed on this principle, and although qualified by the stipulation of the use of 15-A flexibles or some form of additional protection, it is very doubtful if these latter requirements are ever met in practice. The use of small flexibles protected by 15-A fuses is therefore already a common feature of installations.

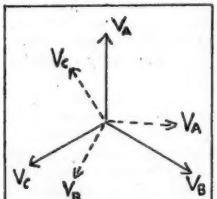
Electric clocks are already catered for by suitably fused clock connectors, and radio sets are, I believe, in many cases similarly provided for by a fuse which is incorporated in the set.

Mr. Jacobi's article provides much food for thought and will serve a valuable purpose, but before his proposals are put into practice I suggest that it should first be ascertained whether it is not merely re-adjustments or improvements of existing tried methods that are actually required.

Coventry. A. J. HEELIS,
Installation Superintendent.
City Electricity Dept.

The Operator j

IN your issue of December 17th, Mr. A. G. Powell in his article has drawn a conventional vector diagram showing the three voltage vectors of a three-phase system but his expressions for the voltage vectors using the operator do not correspond with it, there being a difference of 90 deg. between the algebraic expressions and the graphical representation of the expressions.



The diagram of the vectors drawn in the article is reproduced here and the expressions given are, $V_A = V$, $V_B = V(-0{\cdot}5 - j\,0{\cdot}866)$, and $V_C = V(-0{\cdot}5 + j\,0{\cdot}866)$. The vectors represented by these expressions are shown by chain lines on the diagram herewith.

The following expressions are correct for the vectors illustrated in Fig. 2 of Mr. Powell's article and in this form are much easier to plot on graph paper:—$V_A = V\,j\,1{\cdot}0$, $V_B = V(0{\cdot}866 - j\,0{\cdot}5)$ 4th quadrant and $V_C = V(-0{\cdot}866 - j\,0{\cdot}5)$ 3rd quadrant.

Using these values,

$$I_A = \frac{VA}{2 + j\,1} = \frac{Vj\,1{\cdot}0}{2 + j\,1} = V(0{\cdot}2 + j\,0{\cdot}4)$$ 1st quadrant.

$$I_B = \frac{V_B}{1 - j\,1} = \frac{V(0{\cdot}866 - j\,0{\cdot}5)}{1 - j\,1} =$$

$V(0{\cdot}683 + j\,0{\cdot}183)$ 1st quadrant.

$$I_C = \frac{V_C}{2 + j\,2} = \frac{V(-0{\cdot}866 - j\,0{\cdot}5)}{2 + j\,2} =$$

$V(-0{\cdot}34 + j\,0{\cdot}09)$ 2nd quadrant.

It will be seen from this that the diagram and the above expressions agree.

Mr. Powell goes on to say "the neutral current I_O is the resultant of the three phase currents and equals $(I_A + I_B + I_O)$." This is an error, and one which is constantly occurring. The neutral current is the *reversed* vector sum of the three phase currents and in this case (using the new values shown above for the phase currents) $I_O = -(I_A + I_B + I_C) = -V(0{\cdot}543 + j\,0{\cdot}673)$.

The magnitude of I_O is $V\sqrt{0{\cdot}543^2 + 0{\cdot}673^2}$ (note that the factor V is omitted in the article), and the angle it makes with the horizontal axis is $\tan^{-1} 0{\cdot}673/0{\cdot}543 = \tan^{-1} 1{\cdot}24 = 51°7'$. From this it will be seen that I_O in the diagram is 180 deg. out of its true phase.

Chesterfield. F. C. GILL.

[We have shown Mr. Gill's letter to Mr. Powell, who replies:—" In the vector diagram in this article, the vector V_A was taken as the reference vector and this is clearly stated; hence $V_A = V$, and not $V \times j\,1{\cdot}0$. Obviously the same result is obtained, whatever the reference used, provided the appropriate vector operators are applied. I_O is of course the vector sum of the three-phase currents which is balanced by the neutral current." — EDITORS, ELECTRICAL REVIEW.]

Simplified Notation

THE old habit of writing $\frac{\sqrt{3}}{2}$, etc., is inconvenient for typing and wasteful of space in printed matter while it must be a curse to printers. In Mr. Powell's article in the *Electrical Review* of December 17th we have $\frac{20 - j31{\cdot}4}{20^2 - j31{\cdot}4^2}$ followed by $\frac{V\left(-\frac{1}{2} - j\frac{\sqrt{3}}{2}\right)}{1 - j1}$

The numerator here would be much more sightly written as $V(-{\cdot}5 - j{\cdot}866)$ and it would have taken up less space. In a similar fashion $\sqrt{2}$ should be replaced by 1·414. It is not necessary for practical purposes to go to more than three or four figures, and one doubts if Mr. Powell's ·014425 is really needed: his result of $22{\cdot}3 + j32{\cdot}5$ ohms does not look like it.

Tynemouth. C. TURNBULL.

Removal of Belfast Control

OUR Belfast Correspondent reports:—On January 5th it was learned that the Minister of Commerce and Production had decided to revoke the Order under which Mr. Hugh Boyd, F.C.A., the Government Controller of the Belfast undertaking, was appointed. The control of the undertaking is to be handed back to the Electricity Committee.

Mr. Boyd, a member of the firm of Atkinson & Boyd, was appointed Controller in December, 1941, and carried out his duties without remuneration. The removal of control is accepted as evidence that the Government is satisfied that the undertaking is managed efficiently.

Important developments in regard to electricity undertakings in Northern Ireland may be expected shortly. The question of the control of the Ministry of Commerce's station has been the subject of discussion in Belfast and there is a possibility that some form of unified control of both that plant and the Belfast undertaking will be evolved.

Electrical Materials

Supply and Demand in 1943

Factors which influenced the production and consumption of the principal materials employed in the electrical manufacturing industry during the past year are again surveyed for us by the Metal Information Bureau in the following notes.

COPPER

IN the opening months of 1943 there was a rising pressure of demand for copper, and supplies from American and Empire sources, although on a huge scale, were no more than adequate for essential purposes. About April, however, there were some marked changes in Britain's war production programme, notably a slowing down in shell output, and this not unnaturally had the result of easing the demand for copper, as although other consumption continued to rise it did not offset the economies resulting from the smaller shell output. At the same time increasing production of steel shell cases in America began to have a noticeable effect on the demand for copper, although actually the brass mills there did not reach their peak production until about the middle of the year.

The electrical industry, which throughout the war has been a heavy consumer of copper, has maintained a high rate of activity and continues to do so. Copper producers have had considerable trouble in maintaining their labour forces, and at some properties output has suffered a little. The United States Government released some thousands of men from the army to return to the non-ferrous metal mines. It was announced during the year that the British Government would give financial assistance towards immediate development of large-scale smelting production at the Nchanga property in Rhodesia, and this work is understood to be under way.

Present indications for the coming year are that copper supplies will be ample for all essential needs, and it is possible that restrictions on other consumption may become a little less stringent than they have been during the last two or three years.

TIN

The policy of rigid conservation of supplies, which was instituted immediately after the loss of Malaya and the Dutch East Indies, reached its full efficiency during 1943. Consumption by the United Nations was brought down to the level of production still available—a cut of something like 50 per cent. from the 1941 level—and any fears that might have been entertained about the adequacy of our tin supplies for war purposes disappeared.

Belgian Congo production showed some further expansion, and Nigerian mines produced on as large a scale as possible, regardless of their dwindling ore reserves. Bolivian production failed to show any increase and, indeed, looks as though it was a little below the 1942 level, which in turn was less than that of 1941. For some time now negotiations have been going on between the United States and Bolivia over the price to be paid for Bolivian tin under the new contract, but no decision has yet been reached. The revolution and change of Government in Bolivia at the end of 1943 will, it is stated, have no effect on tin supplies for the Allies.

During the year America brought to the production stage a large capacity for making electrolytic tinplates, and these will account for a substantial proportion of the 1944 output, thus, it is claimed, saving a good deal of tin, or alternatively allowing more tinplate to be made without increasing tin consumption. The leading British tinplate maker has now arranged to install in 1944 an electrolytic tinning line. The use of low-tin solders for most classes of work was widely developed in 1943, although towards the end of the year, with the supply position less unfavourable, restrictions in this direction were not quite as rigid.

On December 31st it was announced that the price of common tin (minimum 99 per cent.) would be raised by £25 per ton to £300 on January 1st, 1944, all other prices being adjusted correspondingly. For a long time tin has been heavily subsidised, and this step was taken to lessen the burden on public funds. Subject to reasonable economy in consumption, there is no reason why tin supplies should cause any worry to the Allied authorities in 1944.

LEAD

Whilst the consumption of lead in this country has kept fairly steady on the whole, with battery and cable makers accounting for the greater part of it, shipping problems, since the Japanese war began, have necessitated imports being kept down to a minimum. As a result restrictions on unessential consumption have been very severe and continue to be so. America, on the other hand, has been happily placed for lead in recent months, and has been able to relax some of the restrictions on civilian consumption. The outlook for 1944, so far as Britain is concerned, seems to hinge entirely upon

shipping, as output from the main overseas Empire sources of production is more than adequate to meet wartime needs.

ZINC

The past year has witnessed a marked change in the zinc supply situation, not only in this country but also in America. The main reason for this was the slowing down in shell production, which sharply diminished not only the amount of zinc required for brass making but also the call for very high-grade metal for zinc alloy die castings. The first effect of this was that imports of high-grade metal from the United States to Britain were stopped, and later imports of ordinary grades were suspended. This naturally helped the American position and the year closed with supplies in both countries fairly plentiful. It has been decided in Britain to release a little more zinc for galvanising, but most of the other restrictions on consumption are still in force.

ALUMINIUM

The gigantic aluminium production programme of the United States in 1943 was fully achieved and, in fact, it was found unnecessary to start up some of the plants that were constructed as, despite steadily growing aircraft output, supplies overtook demand. In Canada also supplies mounted to a thoroughly satisfactory total, and the year closed with some lessening in the severity of restrictions on consumption for non-essential purposes. In Great Britain, as the bulk of supplies have to be imported, tightness in shipping prevented the supply situation becoming at all easy, but, taking a broad view, 1944 may conceivably provide bigger problems in finding outlets for the unprecedented production than in increasing production to meet consumptive requirements.

RUBBER

Despite the many efforts that have been made to stimulate supplies of natural rubber of various kinds to help make good the loss of production from Malaya and the Dutch East Indies, 1943 witnessed an increasing stringency in supplies of natural rubber, and it was officially announced towards the end of the year that in 1944 Britain, as well as America, would have to rely to a very large extent upon synthetic material to meet essential needs. Wherever possible, substitutes for rubber are being used, the electrical industry in particular having had to dispense with rubber insulation, so far as it can. It is believed, however, that there is now adequate productive capacity for synthetic rubber to meet the vital war needs of the Allies, and the promising progress made against the Japanese in the South-West Pacific leads to hopes that it may not be so very long before larger supplies of natural rubber will once again be available.

"Transmitter" Appeal Succeeds

AT the Lancaster Quarter Sessions last week George Baron, solicitor, Bacup, and Henry C. Taylor, Morecambe, appealed against their conviction by the Lancaster County Bench. They had been ordered to pay a fine of £50 each for unlawfully possessing or controlling a wireless transmitter or components capable of being assembled to form a transmitter.

Mr. Blackledge, for the Public Prosecutor, said that all the Bench had had to decide was whether the appellants had a licence or permit and that did not appear to be in dispute. The police had actually transmitted a message with the apparatus. Mr. Baron, conducting his own case, said that a transformer, a tapping key, two accumulators and a relay had been added to it. Capt. Shaw (War Office) said that when he saw the apparatus, without the additions, it could have been used to transmit messages.

Mr. Baron claimed that the apparatus was capable of saving thousands of lives. He said "we can destroy a coil or magneto or anything else with a power which my colleagues have discovered which is invisible and which will deal in just the same way with an aeroplane and a submarine and do many remarkable things." The components were supplied to him at the instance of the Ministry of Supply, the Post Office Research Department and the War Cabinet Committee and all knew the purpose for which they were being supplied.

Mr. Blackledge said that if was unfair to make that statement and said there was almost conclusive evidence that this was a swindle on the public. Sir Edward Appleton had been asked to make an examination but again and again had been baulked for various reasons.

Mr. Buckingham, B.Sc. (Eng.), a member of the Institution of Electrical Engineers, considered that the apparatus should be further examined. There was no foundation for the opinion that it was a swindle.

Mr. Baron submitted that the words "designed to be used" in the Wireless Telegraphy (Possession of Transmitters) Order, 1942 (under which the proceedings had been taken), meant "deliberately designed to be used for the purpose of a wireless transmitter or navigational or landing beacon or indicating direction or position." The Appeals Committee upheld this submission and allowed the appeal, with costs.

Unfenced Machinery

FOR not fencing off dangerous machinery, Desoutter Bros., Ltd., were fined £20 with two guineas costs at Hendon last week. A new drill operator, it was stated, got her hair caught in the spindle of a drilling machine. For the company it was claimed that the accident occurred through the negligence of the operator in not wearing a cap.

COMMERCE and INDUSTRY

No Cost-of-Living Changes. Savoy Lighting Case.

Power Station Fire Guards

A MEMORANDUM has been sent to electricity supply authorities by the Electricity Commissioners on the subject of women fire guards. In an earlier circular undertakings were asked if it was anticipated that women employees would be called upon for fire guard duties in power stations or substation premises and they were told to await instructions in the matter.

The Minister of Home Security has now issued a Direction under Article 15 of the Fire Guard (Business and Government Premises) Order, 1943, that this article shall not apply to premises forming part of an electricity undertaking and consisting of generating stations or attended substations. Consequently women should not be called upon to perform fire guard duties at such premises and any women who are now doing such duties should be removed from the rota.

Women may still be employed as fire guards, if necessary, in administrative or other non-operational premises provided that where these premises form part of the same building or group of buildings as a generating station or substation they should be physically divided from the operational part of the premises.

Power Engineers' Salaries

It is announced that as the cost-of-living index of the Ministry of Labour and National Service shows an average rise of 28·17 per cent. upon the September, 1939, figure for the six months ended December 31st last, the salaries shown in the latest schedule of the National Joint Board for the Electricity Supply Industry remain in force up to June 30th, 1944. These figures were set out in the *Electrical Review* of December 10th last (p. 774).

Wages in the Contracting Industry

Under the revised agreement of September last between the National Federated Electrical Association and the Electrical Trades Union the war addition to wages in the electrical contracting industry was placed on an hourly basis of 4¾d. and this rate was to remain in force until the second pay day in this month. The cost-of-living index has not altered sufficiently to necessitate any adjustment and consequently the addition of 4¾d. per hour will remain in force up to and including the second pay day in April next.

The hourly addition to wages of employees under 21 (Categories II and III) will be as follows:—Under the age of 18; 1¼d.; between the ages of 18 and 21: 2¼d.

"Ironmonger" Diary and Guide

The 1944 issue of the "Ironmonger Hardware Buyers' Guide" gives in concise form a wealth of useful information for those in the hardware trade. In addition to ample diary space, the contents include a buyers' guide to hardware, a list of associations and controls, a section dealing with trade marks and brands and an index to the names and addresses of firms referred to in the buyers' guide pages. The literary section, incorporating the "Hardwareman Year Book," contains articles dealing with a diversity of subjects such as the Purchase Tax, fireguard regulations, postal information, machine tools, etc. The handbook is published by the *Ironmonger*, 28, Essex Street, Strand, London, W.C.2.

Proposed Northern Ireland D.J.B.

It was recently announced that proposals were afoot for the formation of a District Joint Board (Electricity Supply Industry) for Northern Ireland. The Belfast Administrators have informed the Electrical Power Engineers' Association that they are not prepared to support the scheme.

Travelling Scholarships

The Currie Travelling Scholarship is a new award open to competition during 1944 among members of the Institute of Industrial Administration who desire to extend their studies in management in the United States. The scholarship is of the value of £230 to cover the expenses of the winner's residence and travelling. He will be further assisted by the American office of the donor's firm, Stevenson, Jordan & Harrison, Ltd.

Trustees for Sir James Caird's Travelling Scholarships (Engineering and Electricity, etc.) invite applications for one senior scholarship (value £200 to £600) and two junior scholarships (value £50 to £175). Particulars and application forms can be obtained from Mr. J. Pearson, 7, Ward Road, Dundee.

Unauthorised Connection to Radio Relay

An R.E.M.E. craftsman was fined £1 at Kettering on December 29th for an offence which impaired the reception of about 300 subscribers to the local radio relay service. Defendant, who was charged with "maliciously abstracting a quantity of electricity," had opened a sealed junction box on the outer wall of his house and connected a wire between the relay cable and an old loudspeaker. The connection was imperfectly made, and an intermittent short-circuit occurred.

Lighting Summons Dismissed

Mr. McKenna, the Bow Street magistrate, on January 7th granted 40 guineas costs against the Ministry of Fuel and Power in dismissing a summons against the Savoy Hotel Co., Ltd., alleging that it permitted excessive use of electric light in the ladies' reading room at the hotel on November 5th, and another summons against Walter Hore, secretary of the company, for aiding and abetting.

Mr. G. Howard, for the company, submitted that the lights in the reading room actually illuminated through a glass wall the entrance, some stairs and a foyer of the hotel, and that these areas should have been included in the calculations of the Ministry's inspectors.

Mr. McKenna allowed the submission and dismissed the summonses. The Ministry's solicitor said that he would probably ask the magistrate to state a case.

E.D.A. Subscription

The Council of the British Electrical Development Association has decided that the basis of subscription for 1944 shall be fixed at the normal amount and that half of it shall be called for now. So much of the remainder as may be required to meet the Association's expenditure will be asked for later in the year, regard being paid to the desirability of avoiding either a taxable surplus at the end of the year or the necessity for crediting to members the unexpended proportion of their subscription.

The normal subscription is one-tenth of one per cent. of revenue from the sale of units returned to the Electricity Commission: for income tax purposes the Inland Revenue regards it as a " working expense."

The Executive Committee and the Council were influenced in this important decision by consideration of their increased obligations as regards those objects for which the Association primarily exists and their confident assurance of increasing demands in any case but especially if hostilities in Europe cease before the end of the fiscal year. The Central Electricity Board is in complete sympathy with the Council's proposals.

The close of 1943 found the Association already again in the Press while at the same time planning for larger representation in national daily and weekly newspapers and professional and trade journals. Film production has been reintroduced. Many post-war problems, especially in connection with rehabilitation, demand unremitting attention and fairly heavy expenditure must be anticipated for the future.

Special committees are in process of being re-established and the Association is making every preparation to be ready at the right time to promote the interests of the electricity supply industry in a variety of ways.

Power Station Fitters' Wages

Discussion took place at the last meeting of the Liverpool Electric Power and Lighting Committee on an application that the wages of fitters employed at the power stations should be increased to the level of fitters employed in other departments of the Corporation. The Committee whilst sympathetically inclined to the case put forward, considered that the application should be made to the District Joint Industrial Council.

E.C.A. Developments

To avoid confusion with the several committees of similar name which are now in operation the name of the Codes of Practice Committee of the Electrical Contractors' Association has been changed to " E.C.A. Technical Committee."

The Council of the E.C.A. has also set up a new body, the National Retail Trading Committee.

The *Electrical Contractor* mentions discussions which have taken place between the South Staffs branch of the E.C.A. and the Midland Electric Corporation for Power Distribution on post-war planning. The E.C.A. delegates have been asked to prepare a report for the Head Office. Similar discussions are to be commenced shortly with the West Midlands Joint Electricity Authority.

A Tough Lamp

An ordinary 100-W, 250-V " Cosmos " lamp manufactured by the Metropolitan-Vickers Electrical Co., Ltd., has had a remarkable wartime adventure. By inadvertence it became included with a coal shipment and was discovered by an electrician at the end of the voyage. While the discharging of a coal ship was taking place he saw the lamp running along with the coals on a conveyor belt. He took it off perfectly intact and, placing it under test, found it to be undamaged. The surprising part of the story is that the lamp together with some 500 tons of coals, was drafted into the ship's hold. Then a two-ton grab was used for discharging, by which the lamp was picked up, dropped into a hopper approximately 10 ft., from there on to a conveyor belt and thence after a 3 ft. drop to another, and the lamp is still in service.

Lighting of a Machine Shop

A lighting installation recently carried out to a Benjamin specification in a machine shop in the north of England presented certain complications in view of the very considerable amount of overhead shafting along each of the side bays, the fixed and travelling cranes overhead and the varying height of the roof. The installation was planned with the use of lamps varying from 200 W up to 1,000 W, and mounted at heights ranging up to 24 ft. Benjamin " Saaflux R.L.M." reflectors are used throughout, and a very successful illumination is provided averaging 20 ft.-candles with good values on the machines themselves where light is particularly needed. There are also fittings down the outer sides of the shop.

Telling the Workers

The value of their work in the prosecution of the war is not always apparent to a great many industrial workers and consequently firms all over the country have arranged demonstrations of various kinds to show employees how their activities fit into the general programme. One of the latest concerns to undertake this task is Wild-Barfield Electric Furnaces, Ltd.

In this case the demonstration took the form of a small exhibition (400 sq. ft.) in the works. The whole show was centred upon the manufacture and repair of constant speed airscrews, it being felt that it was better to choose one major item rather than to attempt to embrace too many different productions, which could each in turn form the centre piece for subsequent exhibitions. The completed airscrews and component parts and models forming the main exhibits were lent by the De Havilland Aircraft Company, and a complete story was built up round them, helped by many photographs provided by the Ministry of Aircraft Production. Careful planning was needed, therefore, to see that all types of furnaces were embraced in the overall picture, and naturally the story was built up from the more remote stages, which embraced laboratory muffles and toolroom furnaces.

Component parts of a constant speed variable pitch airscrew were displayed together with the completed airscrew, a sectional working model, and photographs of the various types of aircraft fitted with the airscrews. There was a series of photographs depicting a bombing raid, and the importance of furnaces in maintenance and repair was illustrated. Various posters of domestic interest were prepared to link the individuals with the exhibits, and it is believed that at least some of the workers who visited the exhibition were more than surprised to find that their work, which previously they regarded as having little effect on the war effort, was in reality vital and essential.

Crompton Parkinson's Theatre

Crompton Parkinson, Ltd., have offered the organisers of the proposed London Stage Door Canteen the use, rent free, of the Gaiety Theatre, the lease of which the company owns. Owing to the cost and labour required to make the building suitable for the requirements, however, it is considered unlikely that the offer will be accepted.

X-ray Analysis

The third conference on "X-ray Analysis in Industry" has been provisionally fixed for March 31st and April 1st at Oxford. It will be held under the auspices of the X-ray Analysis Group of the Institute of Physics. Particulars can be obtained by non-members from Dr. H. Lipson, hon. secretary of the Group, c/o Crystallographic Laboratories, Free School Lane, Cambridge. While the conference will be open to all who are interested the accommodation available for non-members may place a limit on their numbers.

Hired Installations at Huddersfield

At last week's meeting of the Huddersfield Town Council, states the *Huddersfield Daily Examiner*, the borough electrical engineer reported that Electrical Facilities, Ltd., had refused the offer of the Corporation for the assignment to the Corporation of all rights in the hire purchase of electric wiring, fittings, and accessories installed by the company in premises within the Corporation's area of supply. He also reported on the company's suggestion that the Corporation should undertake the collection of outstanding debts. It was resolved that the Corporation should undertake the collection subject to the company's agreeing to pay a commission of 10 per cent. of the amount collected and to its discontinuing hire-purchase schemes within the Corporation's area of supply.

Killed While Bathing

Through an electric radiator falling into the water when she was having a bath, Maureen Greta Sedgwick, aged twenty, of Mosbro', Derbyshire, received a fatal electric shock on Christmas Eve. At the inquest, Pte. J. T. Price, who forced an entry through the window, said he found her unconscious in the bath with a small bowl-type radiator on top of her. He snatched it off, sustaining an electric shock himself. Artificial respiration was applied without result. It was stated that the radiator was plugged into a lamp socket. There was a joint in the flex where it had been lengthened and this had apparently not been covered with insulating tape. A verdict of "Death by misadventure" was recorded.

Another accident of this kind was described to the Derby coroner when an inquest was held on Cyril Dixon Broadbent, aged twenty-eight, a N.A.A.F.I. canteen manager. P.C. Rhodes stated that he found Broadbent lying dead in a bath with an electric bowl fire in the water near his feet. The fire was connected to an electric light socket, and a window sill above the bath was the only place where the fire could have stood. The coroner, recording a verdict of "Death by misadventure," said it was not long ago that a similar tragedy in Derby had cost two lives. On that occasion he gave a warning against the use of electrical appliances in bathrooms, and it was given such publicity that he thought nobody would do such a thing again. This man had lost his life through disregarding the warning.

Fatal Shock from Radio Lead

A verdict of "Accidentally electrocuted" was returned at an inquest held at Hucknall on an eleven-month-old boy. It was stated that the wires leading to the radio set had broken and the child's father made another connection, wrapping it with insulating tape. The child got hold of the repaired wires and caused a disconnection.

Radio at War

The "Radio at War" exhibition held recently by Bush Radio, Ltd., and described in our issue of December 10th, will until January 28th be on view at the Works Relations Centre, Room 01, Ivybridge House, Adam Street, Strand, W.C.2.

Trade Announcements

The London office of Erskine, Heap & Co., Ltd., has been moved to Rooms 231/232, Grand Buildings, Trafalgar Square, London, W.C.2 (telephone: Abbey 2748/9; telegraphic address unchanged).

New Process Welders, Ltd., are moving their managerial, sales, technical and accounts departments to 76, Victoria Street, London, S.W.1 (telephone: Victoria 1474-5).

Cosway (Sales), Ltd., has transferred its business to Brentwood Road, Tottenham, London, N.17.

Norman Rose (Electrical), Ltd., is combining its despatch facilities at one central address. Correspondence and orders for all departments, general engineering and radio, should now be sent to 26, Elvaston Mews (off Gloucester Road), Kensington, S.W.7 (telephone: Western 0738).

Changes of Name

D. Assersohn, Ltd., 30, Osbourne Road, Acton, W.3, have changed their name to George Forest & Son, Ltd.

The name of Fusarc Welding Co., Ltd., Ling House, Dominion Street, Moorgate, E.C.2, has been changed to Fusarc, Ltd.

Calendar

Mitchell Electric, Ltd., has sent us a calendar with easily readable monthly sheets.

H.V. Substation Unit

Circuit-Breaker with Small Oil Content

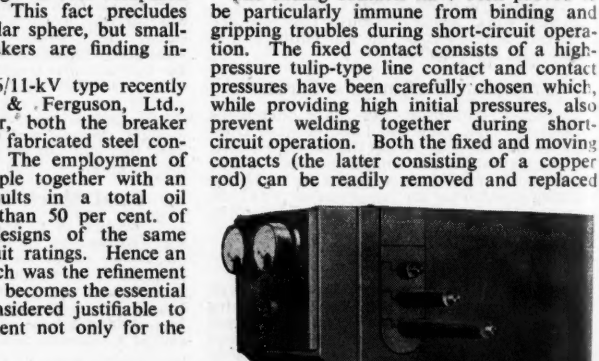
IN the case of conventional substation switchgear used for giving factory supplies from high-voltage systems the oil-less breaker is generally high in cost compared with the oil breaker. This fact precludes its use in this particular sphere, but small-oil-content circuit-breakers are finding increasing favour.

In the 400-A at 6·6/11-kV type recently developed by Cooke & Ferguson, Ltd., Openshaw, Manchester, both the breaker and its housing are of fabricated steel construction throughout. The employment of the single-break principle together with an arc-control device results in a total oil content which is less than 50 per cent. of most contemporary designs of the same current and short-circuit ratings. Hence an arc-control device, which was the refinement of a few years ago, now becomes the essential of to-day. It was considered justifiable to include such a refinement not only for the assistance it gives in reducing the oil content, but also for facilitating the speed of arc interruption, resulting in low tank pressures and slight disturbance during full short-circuit operation. The combination of high mechanism speed with efficient arc control produces interrupting times which bring the breaker within the "high speed" category.

The breaker is designed to be closed by hand, solenoid, or spring, and the tripping mechanism, although extremely stable, is sufficiently light to operate directly from 15-VA current transformers. This excludes the necessity for incorporating relays for overload and earth-leakage protection. The mechanism is trip-free over the entire breaker stroke and is free from the complication of a "force-trip." Self-contained dash-pots, to enable the breaker to be safely operated for testing purposes when the tank is lowered, are provided. Comparatively high speeds are obtained from this design which combines powerful accelerating springs with the minimum number of light moving parts.

Porcelain bushings are employed both in the circuit-breaker and the unit, and although compactness has been achieved throughout the design it has not been at the expense of electrical clearances.

The sliding contacts have been proved to be particularly immune from binding and gripping troubles during short-circuit operation. The fixed contact consists of a high-pressure tulip-type line contact and contact pressures have been carefully chosen which, while providing high initial pressures, also prevent welding together during short-circuit operation. Both the fixed and moving contacts (the latter consisting of a copper rod) can be readily removed and replaced within five to six minutes. The unit and circuit-breaker are fully interlocked while bushing extensions are provided to permit of cable earthing through the breaker.



Cooke & Ferguson fabricated circuit-breaker and housing

The breaker has satisfactorily completed rupturing capacity tests in accordance with B.S. 116/1937 for the rating of 150 MVA at 6·6 kV. A successful series of tests was also carried out on an identical breaker, fitted with bakelised paper bushing insulators, for the rating of 250 MVA at 11 kV, in accordance with B.S. 116/1937. On investigating the ultimate capabilities, the breaker closed fully home on short-circuit and successfully interrupted currents for the full rating of 250 MVA at 6·6 kV.

ELECTRICITY SUPPLY

Limited Plant Operation. Bridlington Post-War Plans.

Belfast.—COAL SUPPLIES.—When the question of coal supplies to the electricity undertaking was raised at a meeting of the City Council, Councillor A. Scott stated that the supply was short. The Committee was not satisfied that everything possible had been done in another quarter and had decided to try to get into direct contact with headquarters in London. In contrast with this statement, Councillor Gillespie, speaking on the minutes of the Gas Committee, declared: "We are better served than any other gas undertaking in the United Kingdom." The situation had very much improved and he did not think they would have any difficulty in meeting the demand. The Coal Controller had treated them in a very nice manner.

Birkenhead.—FUEL ECONOMY.—At a meeting of the Gas Committee it was decided to approach the Electricity Committee regarding the possibility of undertaking a joint advertising campaign on the need for economy in the use of gas and electricity.

Blackpool.—LIMITED OPERATION OF POWER STATION.—At a meeting of the Electricity Committee the electrical engineer reported that with regard to the restriction of generation during certain periods, undertakings had been given that the Corporation would not be penalised in respect of any extra bulk supply of electricity which might be taken under the existing agreement.

Bridlington. — POST-WAR DEVELOPMENT. — Comprehensive proposals for the post-war development of the electricity undertaking are set out in a report by the chairman of the Electricity Committee (Councillor R. Maw) and the commercial manager (Mr. W. M. Brown). Excluding street lighting improvements, the total cost is estimated at approximately £64,000.

Provision of an adequate three-phase supply would cost about £14,200 and three new kiosks, together with a new feeder and other improvements, would cost in the region of £21,400. New showrooms are needed and there is also a scheme (which was being formulated by the Highways Committee at the outbreak of war) for street lighting improvements estimated to cost £4,235.

Mention is also made of the need to adopt a progressive policy of advertising, window displays, demonstrations and exhibitions. Support must be given to the national efforts being made to establish the greatest measure of uniformity of service to the consumers, embracing such questions as conditions of hire, tariff presentation, service cable charges, simpler service connections, kitchen planning, the interchangeability of cooker equipment, and the standardisation of electrical components of appliances in common use.

Burnley.—TEMPORARY CLOSING DOWN OF PLANT.—The Town Council were informed on January 5th that owing to the shortage of fuel the Central Electricity Board proposed a new arrangement for the limited operation of the generating station which, in a few weeks, would close down until next November. Under this scheme neither the Corporation nor consumers would be required to meet any additional cost. Immediately the situation became normal stations would return to full operation.

Cheltenham. — DEMONSTRATION HOUSES. — The local Electric Circle has proposed that demonstration houses should be erected to bring before the public suggestions made by women's organisations and other interested bodies for domestic electrical equipment. This was reported by the borough electrical engineer (Mr. R. W. Steel) at a meeting of the Electricity Committee. It was stated that E.D.A. proposed such a scheme on national lines and the Committee agreed that should it mature the Committee would support it by supplying the necessary apparatus to the Housing Department.

Hull.—WORKING CONDITIONS.—At a meeting of the Electricity Committee the general manager (Mr. D. Bellamy) referred to the working conditions at the power station and stated that he had consulted the medical officer of health and the city analyst with a view to further investigation and amelioration. As part of the investigation the M.O.H. was arranging for X-ray photographs to be made of the staff and workmen.

London.—LIGHTING OF SIDE STREETS.—Battersea Borough Council has approved the acceptance of a quotation of £1,453 for the necessary fittings for a system of modified lighting in side streets. At the Council meeting there was some opposition on the grounds that it would take several months to obtain the necessary equipment and the war might be over this year.

OVERHAUL OF EQUIPMENT.—Southwark Electricity Committee has instructed the borough electrical engineer to arrange for the overhaul of street lighting equipment.

Manchester.—HOSPITAL IMPROVEMENTS.—The Health Committee is to renew the electrical installations at Baguley Sanatorium at a cost of £1,000. A portable X-ray apparatus is to be obtained for Monsall Hospital at a cost of £1,950, and the Committee is also purchasing an electric truck (£225) for the same hospital.

Newcastle-on-Tyne. — MODIFIED LIGHTING. — The Watch Committee has rejected a "star-lighting" scheme for 80 miles of roadway, the estimated cost of installation being £7,600. It recommends an alternative scheme for lighting certain tramway and trolley-bus routes at an estimated cost of £462, and also proposes that the Transport and Electricity Committee shall carry out an experimental form of lighting at a cost not exceeding £100.

Nuneaton.—CHANGE-OVER PLANS.—The electrical engineer recently submitted for consideration alternative methods of procedure with regard to the complete change-over of all supplies to AC. The method previously adopted of finishing a street at a time involved expenditure in changing consumers' apparatus. This might be avoided or considerably reduced if AC cables were laid throughout the area and premises changed over as they became vacant. Many consumers would welcome the opportunity of

having an AC supply available when purchasing new plant. Such a programme would materially reduce the cost of the change-over to the undertaking without penalising consumers. The Electricity Committee recommended that these proposals should be put into effect as soon as possible after the termination of hostilities.

POWER STATION TO BE CLOSED DOWN ?—After considering a report by the electrical engineer on the plant at the power station the Electricity Committee recommended that, subject to the approval of the Electricity Commissioners, the generating station should be closed down as soon as possible. It was further recommended that a sub-committee should be appointed to deal with any questions of displacement or reorganisation of employees.

Plymouth.—DEPUTATION TO COMMISSIONERS.—The Electricity Committee reports that a deputation has interviewed the Electricity Commissioners and submitted further representations in support of the Council's opinion that any further addition to the electricity charges would place an undue burden upon the consumers remaining in the city.

Wimbledon.—REPRESENTATION OF OUTSIDE AREAS.—Besides supplying electricity in Wimbledon the Corporation undertaking also serves the borough of Malden and Coombe and part of the urban district of Merton and Morden. These authorities have now made application for the appointment of two co-opted members from each to serve on the Wimbledon Electricity Committee.

Recently a conference was held at which all three councils were represented, and views were expressed on the subject of reorganisation. It was stated that, while not dissenting from the wider view that electricity distribution should be organised on a national basis, the Corporation was of the opinion that in areas where low charges were in operation provision should be made for these benefits to be retained, at least for a period. Wimbledon was strongly of opinion that reorganisation should follow on the lines of the McGowan Report and that their undertaking should remain a separate unit. Both Merton and Morden and Malden and Coombe representatives supported this view.

Overseas

Australia.—KIEWA HYDRO-ELECTRIC PROJECT.—Some details are published in the *Electrical Engineer and Merchandiser* (Melbourne) of the Kiewa hydro-electric development which is being carried out by the State Electricity Commission of Victoria.

In all, four power stations which will have an installed capacity of 117,000 kW (103,000 kW available continuously) are being built at Bogong High Plains, an elevated plateau in the north-east of the State. In this area there are an annual precipitation (rain and snow) exceeding 80 in., suitable storage sites and a head of about 4,000 ft. in a moderate distance. Development is being carried out in four stages, with heads of about 1,500, 1,500, 360 and 640 ft. and generating capacities of 21,000, 33,000, 24,000 and 39,000 kW.

UTILISING BROWN COAL.—A report in *Tenders* states that it is the intention of the Victorian Government to give early consideration to plans prepared by the State Electricity Commission for the further development of brown coal deposits. These plans would entail an initial expenditure of between £3,000,000 and £4,000,000. Although it will not be possible to implement any proposals during the war, steps will be taken to obtain essential plant.

Canada.—QUEBEC CONCESSION.—Six power companies in the province of Quebec have agreed to a temporary reduction of electricity rates equivalent to one month's free electricity for domestic consumers. They had been ordered to appear before the Quebec Public Service Board to discuss the Board's proposal for a reduction in rates during the last quarter of 1943. Similar moves had previously been made in Ontario and British Columbia. The six companies were Montreal Light, Heat & Power Consolidated; Quebec Power; Southern Canada Power; Gatineau Power; Saguenay Power; and Shawinigan Water & Power. In concurring in the Board's suggestion the companies said it was understood that excess profits taxes would be reduced to correspond with the decrease in revenue and that the temporary reduction would not affect rates in 1944.

Spain.—DEVELOPMENT FORECAST.—In two recent issues of the Spanish journal *Dyna*, of Madrid, Senor Juan de Lasarte Karr deals at length with the production and distribution of electric power in the country. The articles are accompanied by a series of tables and graphs which show that among twelve of the principal countries of the world Spain occupies the penultimate position as regards the output and use of electric power. The figures—the latest available—are for 1941, during which year the country's output amounted to 4,054 million kWh, or about 157 kWh per inhabitant. Senor Karr also attempts to forecast the future development of power production in Spain from 1942 up to 1950. Thus, for 1943 he estimates the output at 4,708 million kWh and the annual increase during the next seven years as between 300 and 500 million kWh, so that he expects production in 1950 to amount to 7,659 million kWh.

RADIO & TELEPHONY

Switzerland.—TELEPHONE PROGRESS.—In a report on the activities of the Swiss Posts, Telegraph and Telephone Department during 1942 the *Journal des Télécommunications* states that at the end of the year there were 946 exchanges, of which 804 are now automatic and serve about 89 per cent. of the total number of subscribers (529,830). The same journal also reports that in July of last year a new telephone cable was laid between the towns of Bulle and Lausanne. The line is about 29 miles long and for part of its length comprises 124 pairs of conductors.

The "Electrical Age"

TO discover how readers like "The Electrical Age" in its new form, slips are enclosed for them to give marks for the articles in the January issue. To add interest, a book token of one guinea will be awarded to the Electrical Association for Women branch returning the greatest number of slips in proportion to its membership.

Cast Iron

Its Functions in Electrical Engineering

By "Designer"

IN the past engineers have understood cast-iron to be a machinable furnace mixture of pig-iron and scrap cast-iron forming an alloy of iron and carbon. The carbon exists in varying proportions, but mainly in a combined condition in the form of iron carbide structures, the remainder being free carbon in the form of flake graphite. The amounts of combined and free carbon are largely determined by the proportion of certain other elements in the mixture, such as, silicon, manganese, sulphur and phosphorus.

The best iron for machining purposes is grey cast-iron, which contains combined graphitic carbon. White cast-iron contains little silicon and the iron is brittle with a white or silvery fracture.

Tensile Strength

The criterion of quality in cast-iron is its ultimate tensile strength, although this may not be the most suitable test, and large quantities of cast-iron are still made having a tensile strength as low as 8 tons per sq. in.; twenty-five years ago this was fairly general. Since that time marked advances have been made in metallurgy and foundry technique. The term "cast-iron" covers the whole range of iron-carbon alloys having a carbon content in excess of that found in steel. Commercial cast-irons have, as cast, usually a carbon content of 3·2 per cent.; the amount of combined carbon is 0·5 to 0·8 per cent. the balance being graphite.

While the mechanical engineer is mainly concerned with the strength of materials, the electrical engineer utilises iron having special properties to meet special situations, such as resistance to heat in the case of hot-plates, magnetic properties or otherwise.

Fractured cast-iron is either grey, mottled or white. The grey fracture is due to the presence of graphite the size of which determines the openness or closeness of the fracture. The fracture is taken as an empirical guide to the selection of raw materials and the microscope provides information about the structure.

Pure iron, such as electrolytic or wrought iron, consists of grains or crystals of the soft ductile metal termed ferrite or α-iron. Ferrite may contain nickel, manganese or silicon and is found in wrought iron or mild steel. An increase of carbon leads to the formation of "cementite," Fe_3C, *i.e.*, the hard crystalline compound of iron and carbon. Primary cementite freezes out above the lowest melting temperature or eutectic point. With it may be associated other carbide formers such as manganese or chromium. A pure iron-carbon alloy has its lowest freezing point when it contains 4·3 per cent. carbon, but this can be lowered by 0·3 per cent. for each 1 per cent. of silicon or phosphorus included in the mix. The commoner cast-irons in use in engineering have a eutectic value with 3·5 per cent. carbon content but usually contain less carbon than the eutectic value. They thus have not the graphitic coarseness found in irons of a higher carbon content. An engineering iron on solidifying deposits crystals of "austenite" or γ-iron with carbon in solid solution which is relatively soft and ductile.

Austenite is non-magnetic and is known by such trade names as "No Mag," "Ni-Resist" or "Nicrosilal." The product may contain up to 14 per cent. nickel. When the temperature of the iron falls to 740 deg. C. the mixture begins to reject carbon and forms the duplex structure called "pearlite," This is an intimate mixture containing 87 per cent. of ferrite and 13 per cent. of cementite.

Modern irons contain a proportion of pearlite and graphite, but if excess silicon is present some of the pearlitic graphite will break down leaving ferrite. Special conditions of composition, cooling or subsequent heat treatment may modify the components of the structure, thus leading to the formation of sorbite, martensite or troostite. Martensite consists of fine-grained α-iron containing atoms of dispersed carbon but not in solid solution. It gives a steel structure of great hardness which is greatest with a carbon content of 0·7 per cent. Low-carbon steels require more drastic quenching to produce martensitic iron, which is always magnetic.

Conductivity and Other Properties

Ferrite, pearlite, austenite and cementite have conductivities diminishing in the order given. The electrical resistance of grey cast-iron is 60 to 100 units (microhms per $cm.^3$) and of austenitic cast-iron about 150. The magnetic permeability of grey cast-iron is 240 units and of austenitic cast-iron 1·03, indicating that the latter is virtually non-magnetic.

Grey and white cast-irons give good resistance to wear and also to corrosion when the silicon value is high (say 15 per cent.). The addition of 10 per cent. of chromium gives good resistance to heat corrosion and erosion, especially where sulphurous gases are present. "Ni-Resist"

and "Nicrosilal" of the austenitic type are 3 to 600 times as resistant to corrosion as pearlitic irons. Ordinary cast-irons are used widely where resistance to heat is required, but at high temperatures they tend not only to scale but also to increase in volume (growth).

Growth in cast-iron is due to graphitisation of the combined carbon, internal oxidation and cracking consequent on volume change which sets up stresses which crack the iron. Where machining is not necessary and brittleness is not a draw-back, white cast-iron which is free from graphite may be used. For machinable irons subject to heat, such as hotplates, a low silicon-content fine-grained structure is recommended, so long as the running temperature does not exceed the critical point, 700 to 750 deg. C.

Irons of the "Silal" type containing 5 to 6 per cent. of silicon have good resistance to scaling and growth but are rather brittle, since they are ferritic and have no carbide to break down under heat. Silicon raises the critical point to 900 deg. C. The austenitic irons "Nicrosilal" and "Ni-Resist" give good resistances to growth and scaling and can be used for high temperatures. An aluminium-chromium cast-iron has now been developed for heat resistance under the name "Cralfer." Irons containing silicon and aluminium are apt to be brittle when cold, but are stronger at operating temperatures than pearlitic irons.

About the year 1925 alloy additions were made to cast-iron, the first being nickel which nowadays is widely used. It is mildly graphitising and can usefully replace silicon. Work has also been done on the addition of steel scrap to charges for making cast-iron with a tensile strength of 20 to 23 tons per sq. in. These figures are associated with a carbon content of 2·2 per cent. and a silicon value of 2·5 per cent. or over to maintain ease of machining.

Low carbon content gives rise to shrinkage difficulties and it is common practice to maintain the carbon content at not less than 2·6 per cent. with silicon values of 2·0 to 2·5 per cent. This gives a lower tensile strength but a sounder casting. Materials of this type are used for medium and heavy engineering castings and meet B.S.S. 786 grade 2 requirements.

The irons most suitable for certain duties in the electrical industry are as follows:—For generator end covers, armature end shields, busbar chambers and resistance grids: "No Mag" cast-iron developed for its non-magnetic properties. For hotplate tops: nickel-low-silicon cast-iron, nickel-chromium cast-iron, "Mechanite," "Ni-Resist" and "Nicrosilal." For furnace hearths: "Ni-Resist" and "Nicrosilal." For electrodes for rheostats: "Ni-Resist."

Bibliography.—First, Second and Third Reports of the Research Committee on High-Duty Cast Irons for General Engineering, published by the Institution of Mechanical Engineers.

Chilean Electrical Imports

IN 1942 Chilean electrical import trade increased slightly on the whole, declines in certain groups being offset by increases in others. Among the latter those in cables and radio sets were noteworthy. The accompanying table gives the values in 1942 in thousands of pesos (peso equals 6d.) of such items as are given in the official statistics of the country, notes of increases or decreases compared with 1941 being added.

Class of Imports	1942 Pesos (000)	Inc. or dec. on 1941 Pesos (000)
Dynamos, alternators, etc.	1,300	—
Electric motors	1,500	− 600
Parts and accessories for motors ..	2,200	− 700
Cables and flex	4,400	+ 700
Current meters and parts	550	− 100
Telegraph and telephone apparatus ..	700	− 500
Radio receivers and transmitters ..	480	+ 265
Radio valves and parts	700	− 500
Lamps, incandescent, for lighting and heating	1,600	—
From Argentina	230	+ 126
„ United States	1,323	+ 218
Cookers, heaters, etc.	550	+ 210

With regard to countries of supply no information is yet available except for lamps.

According to *Foreign Commerce Weekly*, direct telephone service between Arica and Santiago, Chile, was inaugurated early in May. Since local demands for service are very light in some sections, installation of land lines for those districts was considered impractical and it was decided to utilise radio. The establishment of this service is reported to be of particular significance because, now, for the first time, through telephone connections can be made from Magallenes in the extreme southern part of Chile to Arica in the extreme north—a distance greater than from New York to San Francisco (about 3,200 miles).

General prospects in Chile are, of course, governed by war conditions and will develop in tune with the demand for copper and nitrate which are the country's staple exports. In 1943 the level of both mining and manufacturing production varied but little from twelve months previously. The most-favoured-nation agreement with Canada has recently been ratified.

Aircraft Finishing

Infra-Red Heating in Paint Shops

THE value of high-class finishing on modern high-speed aircraft is too well known to need any amplification, but the attainment of such finishes has often been limited by the "bottle-neck" in the paint shop where lack of both space and time make it impossible to allow ten to twelve hours of idle time while paint and putty filling dry.

"Metrovick" infra-red heating equipment for aircraft assemblies

The solution has now been found in the adoption of synthetic paints and putties which stove at a temperature of some 150° F. and by the use of infra-red radiation which has two great advantages. First, the heat is generated within the paint film and is largely reflected by the metal skin; thus built-in components which are shielded from direct radiation must be at a lower temperature than the paint film itself. Second, the generation of heat within the film prevents the formation of a dry surface film, trapping solvents in the under layers.

Comparative times between the steam ovens which were formerly in use at one large aircraft factory and infra-red plant give an excellent indication of the way in which a saving of some 90 per cent. of the time has been achieved. For example, with infra-red heating the drying of the fuselage takes 1 hr. 10 min., whereas with the steam-oven method the time was 12 hr. For the first and second primings, filler and camouflage the time in each case has been reduced from 2 hr. to 10 min. and for putty, from 4 hr. to 30 min. Total consumption (infra-red method) is 81 kWh (initial heating load 96 kW; and load needed to maintain the desired temperature, 54 kW). Drying of the wing by the old method took 6 hr. and by the new method 30 min. (38¾ kWh; heating load 102 kW and heat maintenance load 51 kW). The drying time for the leading edge of the wing has been reduced from 10 hr. to 1 hr., with 28 kWh consumption and loads of 40 and 20 kW.

Temperature control is effected by means of switching on or off different combinations of lamps. The plant illustrated is designed to take either a main wing, fuselage or the leading edge of the wing only, the correct combination of lamps being selected automatically by pressing a button; at the same time an automatic timing device is put into operation which switches out the required number of lamps after a lapse of approximately five minutes when the desired temperature has been reached. The timing device then operates again after a further five or twenty-five minutes according to whether paint or putty is being dried. Thus the operative has only to select one of five suitably labelled push buttons and leave the plant to complete the process by itself. A clear indication of the completion of the process is given when all lamps are out.

The experimental work and equipment of the tunnels were carried out by the Metropolitan-Vickers Electrical Co., Ltd.

Ship Welding

THE course of lectures delivered last winter at Stow College, Glasgow, under the ægis of the Admiralty, with the co-operation of the Ministry of Labour and National Service, the Institute of Welding and the Shipbuilding Employers' Federation, has been reproduced in book form ("Electric Welding in Shipbuilding," 372 pp.; Stationery Office, 7s. 6d.). It is intended for the instruction of workers in the shipbuilding industry who have not been able to obtain more than a passing acquaintance with those branches of applied science that are involved in the arc welding process.

Intensification of production created a need in shipyards for men sufficiently conversant with welding design to be capable of applying the principles to shipwork. The Stow College courses were organised to satisfy that need, the men attending them being experienced workers sent straight from yards keyed up to wartime output pitch.

In compiling this volume an effort has been made to preserve the lecture form of the twenty contributions, each complete in itself with their respective authors' free expressions of opinions; each author is given a biographical note at the head of his section. There has not been any attempt to impose uniformity of style or approach to the various subjects here collated in general outline. The observations made by way of suggestion from actual experience remain as constructional hints based on established fundamental principles.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Turner & Newall, Ltd., report a profit of £2,710,801 for the year ended September 30th, an increase of £303,251 compared with the previous twelve months. This figure was arrived at after providing for expenses, bad debts, mines amortisation and provision of £192,020 by subsidiaries for U.K. income-tax liability. Depreciation takes £199,211 (£188,196) directors' fees, £2,631 (£2,296), income tax, N.D.C. and E.P.T. of the company and its subsidiaries, £1,955,667 (£1,686,218), leaving a net profit of £553,292 (£530,840). After paying preference dividends and a final ordinary dividend of 8¾ per cent., again making 12½ per cent., the welfare trust is once more allocated £10,000 and the general reserve £100,000 (same), leaving £99,457 (£78,440) to be carried forward.

Tecalemit, Ltd.—At the annual general meeting Mr. S. G. Gates, chairman, mentioned that a maiden dividend had been received from the company's Australian subsidiary, and that a shareholding had been acquired in T.K.S. (Aircraft De-Icing), Ltd. The directors were neglecting nothing they could rightfully do to assure Tecalemit its rightful place after the war; meanwhile they took the view that it was in the company's best interests to maintain a conservative policy. For this reason they recommended that the final dividend should remain unchanged at 12 per cent., making 18 per cent. for the year.

New Companies

Plasticable, Ltd.—Private company. Registered December 28th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, plastics, plastic electrical insulation, electrical plant and accessories, etc. Dr. M. J. Cotter, 71, Mansell Road, Greenford, Middlesex, is the first director. Secretary: R. H. Dutchman. Registered office: Cross Keys House, 56, Moorgate, E.C.2.

Manchester Electrical Repairs Co., Ltd.—Private company. Registered January 1st. Capital, £4,000. Objects: To acquire the business of the Electrical Repairs Co., carried on by H. Haughton, at Goolden's Buildings, Great Ancoats Street, Manchester, and to carry on the business of electrical engineers. Directors: H. Haughton, 2, Shirley Avenue, Denton (permanent managing director); and A. Rigby, 218, Grey Mare Lane, Openshaw, Manchester. Registered office: Goolden's Buildings, Great Ancoats Street, Manchester.

Cable Assemblies, Ltd.—Private company. Registered December 24th. Capital, £1,000. Objects: To carry on the business of manufacturers and assemblers of electrical accessories and ancillary equipment, cables, switches, switchgear and electrical and mechanical instruments, manufacturers, processors and converters of rubber, plastic and insulating materials, filmic materials and adhesive binding, etc. Directors: S. McCombie, C.A., 11, Lister Avenue, Hitchin; and F. G. Moore, 5, Densley Close, Welwyn Garden City. Registered office: 15, Bessemer Road, Welwyn Garden City, Herts.

Edgar Lowe, Ltd.—Private company. Registered in Belfast December 23rd. Capital, £5,000. Objects: To carry on the business of electrical engineers and contractors, wireless, mechanical and general engineers, etc. First directors: J. E. Lowe and Agnes E. Lowe, both of Killynure, Carryduff, Co. Down. Registered office: 5, Ormeau Avenue, Belfast.

Companies' Returns

Statements of Capital

Castle Fuse & Engineering Co., Ltd.—Capital, £15,000 in 15,000 shares of £1 each. Return dated September 13th. All shares taken up. £13,000 paid. £2,000 considered as paid. Mortgages and charges: £119 3s. 10d.

Electrical Facilities, Ltd.—Capital, £350,000 in £1 shares. Return dated October 20th. 291,667 shares issued and fully paid up (+ 2s. 6d. per share premium on 91,667 shares). Mortgages and charges: Nil.

L. Nicholson & Co., Ltd.—Capital, £6,000 in £1 shares. Return dated July 13th, 1943 (filed December 10th, 1943). 4,550 shares taken up. £952 paid. £3,598 considered as paid. Mortgages and charges: Nil.

Normand Electrical Co., Ltd.—Capital, £20,000 in £1 shares. Return dated July 20th (filed September 7th). 12,448 shares taken up. £12,448 paid. Mortgages and charges: Nil.

Mortgages and Charges

Electrical Equipments (Cardiff), Ltd.—Assignment of proceeds of contract, dated December 4th, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Felgate Radio, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated December 14th, to secure £1,250. Holder: Felix J. Benzimra, East House, 1a, Addison Crescent, W.14.

Regentone Products, Ltd.—Satisfaction in full on November 22nd, of second mortgage, dated November 7th, and registered November 8th, 1935.

Bankruptcies

T. G. Helme, electrical equipment manufacturer, lately carrying on business at Imperial House, 80-86, Regent Street, London, W.1.—Application for discharge to be heard on January 20th at Bankruptcy Buildings, Carey Street, London, W.C.2.

A. W. Sommer, radio dealer, carrying on business at 20, Belmont Circle, Harrow, Middx.—First and final dividend of 2 ⅓d. payable at Bankruptcy Buildings, Carey Street, London, W.C.2.

MINISTRY OF SUPPLY

Better be sure than sorry

Do not wait until trouble occurs—check over your electrical equipment regularly.

The Control of Industrial Electrical Equipment (No. 1) Order, 1943 restricts the supply of spare motors in order to make more available for vital war purposes and, as a consequence, inspection and maintenance are more than ever necessary.

See that motor and starter terminal connections are tight; loose connections frequently cause "single-phasing" and burning out of A.C. motors.

Minor Repairs PREVENT *Major Breakdowns*

ISSUED BY THE D.I.E.E. IN COLLABORATION WITH BRITISH ELECTRICAL MANUFACTURERS

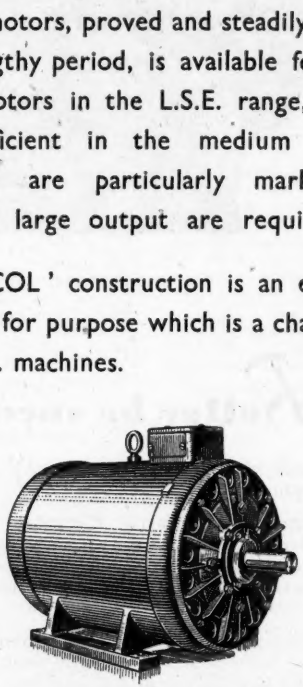
This space is provided by

VERITYS LIMITED BIRMINGHAM

EMCOL

The 'EMCOL' principle of cooling totally enclosed motors, proved and steadily improved over a lengthy period, is available for practically all motors in the L.S.E. range, A.C. and D.C. Efficient in the medium sizes, its advantages are particularly marked when motors of large output are required.

The 'EMCOL' construction is an example of the fitness for purpose which is a characteristic of all L.S.E. machines.



LAURENCE, SCOTT & ELECTROMOTORS LTD.

ELECTRICAL ENGINEERS FOR SIXTY YEARS

NORWICH • MANCHESTER • LONDON AND BRANCHES

STOCKS AND SHARES

TUESDAY EVENING.

THE attention of the public is so keenly occupied by war conditions and news that it is not surprising to find Stock Exchange markets to some extent neglected. The turn of the year brought in a certain amount of money, as it always does, for employment. Gilt-edged and speculative investment issues were the particular subject of demand. Amongst the speculative shares in which there is anything like a lively market, cinema and radio take front place. An improvement in Home Railway stocks is seasonal, in view of the imminence of the dividend declarations. Equipment and manufacturing shares are better. Communication stocks gained ground.

Home Railways Harden

The Home Railway market, as is not unusual at this time of year, makes a better showing, in consequence of the close approach of the dividend declarations in respect of 1943. The first are made in the middle of February. Inquiry is directed not only to the junior stocks, but also to those in the prior-charge group affected, ordinarily, by money considerations. London Passenger Transport senior stocks are better than they look, to use the Stock Exchange phrase, which means that the stocks are easier to sell at the quoted prices than they are to buy. There is, in point of fact, little stock about and the prices in our tables are to some extent nominal, except as regards the "C" stock, in which there is a fairly free market. The price of the last-named is unchanged at 65. No official statement has been made as to the probable dividend declaration date. Market opinion looks for the announcement to be made on February 17th.

Electricity Supply Ordinary

Edmundson's ordinary have come on offer as to 5,000 shares at 29s. 6d. at which price the return on the money is £4 1s. 3d. Other shares in this group of which there is a supply available at the moment are London Electric Supply ordinary at 28s. 6d., yielding £4 4s. 3d. and with a full year's dividend due in March. Midland Electric Corporation ordinary shares can be bought at 43s. 3d. to give, by an odd coincidence of figures, £4 3s. 3d. per cent. The same yield is obtainable from Mid-Cheshire Electric ordinary at 39s. 3d. The dividend here also is paid once a year in March. A third electricity supply company which pays annually in March is Llanelly & District, 1,000 of whose ordinary shares can be obtained at 25s. 9d. to return £4 13s. per cent. The company raised its dividend for 1942 to 6 per cent., after paying an annual 5½ per cent. for some years previously. British Power & Light at 33s. 6d. yield £4 3s. 6d. at that price.

In each of the cases mentioned here, shares are on offer in the Stock Exchange market at the prices quoted. Probably the prospective buyer may be able to get them a little more cheaply.

Price Fluctuations

British Insulated have risen to 5 7/16, and General Electric ordinary are 1s. better at 89s. 6d. The latter company's 6½ per cent. preference at 32s. 6d.—at which the yield is a level 4 per cent.—have risen 6d. A gain of 1s. 6d. lifted Associated Electricals to 50s. 6d. and Tube Investments are half-a-crown higher at 94s. English Electrics and London Electric Wires put on 1s. apiece. At 57s. Automatic Telephones are 9d. up. Improvements of 6d. made Ever Ready 39s. 6d., Falk Stadelmann 32s. 6d., Johnson & Phillips 67s., and Telegraph Constructions 50s. Thorn Electrics are a shade harder at 22s. The market, as these rises indicate, is a good one. There is no large supply of stock to meet the persistent demand and, in these companies, the post-war prospects are deemed to hold good promise of expansion in profits and dividends. De la Rue hold their advance to 8⅓. J. & F. Stone Lighting & Radio at 6s. 3d. have gained the pence.

Animated dealings in radio shares left the prices better. Philco rose 6d. to 12s. 6d., "Emi" 3d. to 28s. and E. K. Cole to 26s. ex-dividend; the last-named are 1s. up. Cossors remained relatively quiet around 22s. 6d.

The Bewildered Investor

Investment finds that the present financial outlook is more confused than it has been at any period during the war, except, perhaps, in the first two or three months after the outbreak in September, 1939. The uncertainties of that time became quickly resolved as the war effort began to settle into its stride. Notwithstanding the pressure of taxation, war conditions have contributed largely to successful maintenance of industry, and of profits made by industrial companies. Now, however, the air being charged with peace possibilities, the perplexity of the financial situation is increased manifold. Should there be a sudden change-over to peace conditions, it is contended that the industrial machine will suffer so severe a jolt that many companies may be faced with the prospect of diminished earnings and a corresponding shrinkage of profits.

Hear Both Sides

The argument on the other side of the shield is that, even if European peace should come within the next few months, the reconstruction of the world will require all the energies,

(*Continued on page* 69)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Jan. 11	Rise or Fall	Yield p.c. £	s.	d.
Home Electricity Companies							
Bournemouth and Poole	12½	12½	61/6	..	4	2	0
British Power and Light	6	7	32/6	..	4	6	2
City of London	7	7	28/–	..	5	0	0
Clyde Valley	8	8	42/–	+1/–	3	16	0
County of London	8	8	41/–	..	3	18	0
Edmundsons:							
7% Pref.	7	7	34/–	..	4	2	4
Ord.	6	6	28/6	..	4	4	3
Elec.Dis.Yorkshire	9	9	44/–	..	4	1	10
Elec. Fin. and Securities	12½	12½	53/6	..	4	13	4
Elec. Supply Corporation	10	10	46/–	..	4	7	0
Isle of Thanet	Nil	Nil	18/–	..		—	
Lancs. Light and Power	7½	7½	35/6	+1/–	4	4	6
Llanelly Elec.	5½	6	25/–	..	4	16	0
Lond.Assoc.Electric	4	3	23/–	..	2	12	4
London Electric	6	6	27/6	..	4	7	3
LondonPowerRed. Deb.	5	5	104½	+1	4	15	7
Metropolitan E.S.	8	8	41/6	..	3	17	0
Midland Counties	8	8	39/–	..	4	2	1
Mid. Elec. Power	9	9	42/6	..	4	4	9
Newcastle Elec.	7	7	31/–	..	4	10	5
North Eastern Elec.:							
Ordinary	7	7	32/6	..	4	6	2
7% Pref.	7	7	34/6	..	4	1	2
Northampton	10	10	48/–	..	4	3	4
Notting Hill 6% Pref. (£10)	6	Nil	10	..		—	
Northmet Power:							
Ordinary	7	7	38/–	+6d.	3	13	8
6% Pref.	6	6	30/6	+6d.	3	18	8
Richmond Elec.	6	6	26/–	..	4	12	4
Scottish Power	8	8	40/–	+6d.	4	0	0
Southern Areas	5	5	22/6	..	4	9	0
South London	7	7	27/–	..	5	3	8
West Devon	5	5	23/6	..	4	5	0
West Glos.	4½	3½	24/–	..	2	18	4
Yorkshire Elec.	8	8	42/6	..	3	15	3
Overseas Electricity Companies							
Atlas Elec.	Nil	Nil	6/9	..		—	
Calcutta Elec.	7*	6*	35/–	..	3	8	8
Cawnpore Elec.	10	10	35/–	..	5	14	3
East African Power	7	7	33/–	..	4	4	10
Jerusalem Elec.	7	5	28/–	..	3	11	5
Kalgoorlie (10/–)	5	5	10/–	..	5	0	0
Madras Elec.	4*	Nil	23/6	+6d.		—	
Montreal Power	1½	1½	21	..	6	19	6
PalestineElec."A"	4*	5*	40/3	..	2	9	10
Perak Hydro-elec.	6	7	10/–	..		—	
Shawinigan Power	83cts.	90cts.	16	..		—	
Tokyo Elec. 6%	6	6	18	–1		—	
VictoriaFallsPower	15	15	4¾xd	+⅛	3	8	7
Whitehall Inv.Pref.	—	—	24/–	..	4	3	4

Company	Dividend Previous	Dividend Last	Middle Price Jan. 11	Rise or Fall	Yield p.c. £	s.	d.
Public Boards							
Central Electricity:							
1955–60 (Civil Defence)	—	3	100	..	3	0	0
1955–75	5	5	115	..	4	7	0
1951–73	4½	4½	107	+1	4	4	3
1963–93	3½	3½	102½	..	3	8	4
1974–94	3½	3½	100	+1	3	5	0
LondonElec.Trans. Ltd.	2½	2½	97	..	2	11	3
London & Home Counties1955–75	4½	4½	112	+1	4	0	4
Lond.Pass.Trans.:							
A	4½	4½	119½	+1	3	15	4
B	5	5	119½	+1	4	3	8
C	2½	3	65	..	4	12	4
WestMidlandsJ.E.A. 1948–68	5	5	109	..	4	11	9
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref.	6	6	114½	..	5	4	10
Def.	1½	1½	28	..	5	7	1
Anglo-Portuguese	8	8	24/–	..	6	13	4
Cable & Wireless:							
5½ Pref.	5½	5½	113½	+½	4	17	0
Ord.	4	4	79	+1½	5	1	3
CanadianMarconi$1	Nil	4cts.	8/–	..		—	
Globe Tel. & Tel.:							
Ord.	8¼*	5*	37/6xd	+6d.	2	13	4
Pref.	6	6	30/–xd	+1/–	4	0	0
Great NorthernTel. (£10)	Nil	Nil	22½	..		—	
Inter. Tel. & Tel.	Nil	Nil	15	+1		—	
Marconi-Marine	7½	7½	32/3	..	4	13	0
Oriental Tel. Ord.	16	10	45/–	+1/–		—	
Telephone Props.	6	Nil	17/6	..		—	
Tele.Rentals(5/–)	10	10	11/6	..	4	7	0
Traction and Transport							
Anglo-Arg.Trans.:							
First Pref. (£5)	Nil	Nil	3/–	..		—	
4% Inc.	Nil	Nil	8½	..		—	
Brit.Elec.Traction:							
Def. Ord.	45	45	1085	+40	4	2	7
Pref. Ord.	8	8	175	..	4	11	5
Bristol Trams	10	10	52/–	..	3	17	0
Brazil Traction	$1	$1⅛	27	+⅛	6	10	0
Calcutta Trams.	5½	6½	36/–	..	3	13	5
Cape Elec. Trams	5	6	24/–	..	5	0	0
Lancs. Transport	10	10	44/3	..	4	10	4
Mexican Light:							
1st Bonds	5	5	103½	..	4	16	7
Rio 5% Bonds	5	5	105½	–1	4	14	9
Southern Rly.:							
5% Prefd.	5	5	77	+1	6	9	7
5% Pref.	5	5	116½	+½	4	5	10
T. Tilling	10	10	54/6	..	3	13	3
West Riding	10	10	44/–	..	4	11	0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Jan. 11	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron. Elec. Ord. .	10	15	55/–	..	5 9 1
Assoc. Elec.:					
Ord.	10	10	50/6	+1/6	3 19 0
Pref.	8	8	38/6	..	4 3 1
AutomaticTel.&Tel.	12½	12½	57/–	+9d.	4 7 8
Babcock & Wilcox	11	11	48/9	+3d.	4 10 2
British Aluminium	10	10	47/6	..	4 4 0
British Insul. Ord.	20	20	5⅞	+⅛	3 13 4
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
BritishVac.Cleaner (5/–)	15	30	27/–	..	5 11 1
Brush Ord. (5/–)	6	8	8/6	..	4 14 2
Burco (5/–) ..	15	17½	15/3	..	5 14 9
Callender's ..	15	20	99/–	..	4 1 0
ChlorideElec.Storage	15	15	80/–	..	3 15 0
Cole, E. K. (5/–)	10	15	26/–xd	+1/–	2 17 10
Consolidated Signal	17	24	5½	..	4 5 1
Cossor, A. C. (5/–)	7½*	10*	22/6	..	2 5 6
Crabtree (10/–) ..	17½	17½	36/9	+6d.	4 15 1
CromptonParkinson Ord. (5/–) ..	20	22½	27/–	..	4 3 4
E.M.I. (10/–) ..	6	8	28/–	+3d.	2 17 2
Elec.Construction	10	12½	50/6	..	4 19 0
Enfield Cable Ord.	12½	12½	59/ –	..	4 4 8
English Electric..	10	10	48/6	+1/–	4 2 6
EnsignLamps(5/–)	25	15	20/–	..	3 15 0
Ericsson Tel. (5/–)	22*	20*	51/3	..	1 19 0
Ever Ready (5/–)	40	40	39/–	+6d.	5 2 7
Falk Stadelmann	7½	7½	32/6	+6d.	4 12 4
Ferranti Pref. ..	7	7	29/6	..	4 15 0
G.E.C.:					
Pref.	6½	6½	32/6	+6d.	4 0 0
Ord.	17½	17½	89/6	+1/–	3 18 2
Greenwood&Batley	15	15	41/3	..	7 5 9
HallTelephone(10/–)	12½	12½	25/6	..	4 18 1
Henley's (5/–) ..	20	20	25/–	..	4 0 0
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	60/–	..	5 16 8
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	..	4 16 0
Johnson & Phillips	15	15	67/–	+6d.	4 9 3
LancashireDynamo	20	22½	92/–	..	4 18 6
Laurence,Scott(5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	34/6	+1/–	4 7 0
Mather & Platt ..	10	10	52/–	..	3 18 9
Metal Industries(B)	5	8	44/3	..	3 12 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	100/–	..	4 0 0
Pye Deferred (5/–)	25	25	26/3	..	4 15 3
Revo (10/–) ..	17½	17½	38/9	..	4 10 6
Reyrolle ..	12½	12½	70/–	..	3 11 5
Siemens Ord. ..	7½	7½	33/–	–6d.	4 11 0
Strand Elec. (5/-)	7½	10	7/9	..	6 9 0
Switchgear&Cowans (5/-) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	50/–	+6d.	4 0 0
TelephoneMfg.(5/–)	9	9	11/–	..	4 1 10
Thorn Elec. (5/–)	20	20	22/3	+3d.	4 11 0
Tube Investments	20	20	94/–	+2/6	4 5 1
Vactric (5/–) ..	Nil	Nil	14/3	–3d.	—
Veritys (5/–) ..	7½	7½	7/3	..	5 3 5
Vickers (10/–) ..	10	10	17/6	..	5 14 3
WalsallConduits(4/–)	55	55	45/–	..	4 17 9
Ward & Goldstone (5/–)	20	20	27/3	..	3 13 5
WestinghouseBrake	10	12½	65/–	..	3 17 0
West, Allen (5/–)	7½	7½	6/9	..	5 11 2

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 67)

machinery and materials that can possibly be put into operation, and that industrial companies will find sufficient business to keep them employed for years to come.

Between these two main arguments there are many subsidiaries. From the steadiness that characterises prices of ordinary shares in the best class companies, the investor obviously intends to "stay put"—at all events for the time being. Not knowing in which direction to turn, he contends that post-war possibilities are sufficiently bright to warrant his continued retention of the shares.

Globe Telegraph & Trust

Better prices for Cable & Wireless ordinary and preference stocks indicate the hand of the investor and his readiness to accept a 5 per cent. yield, such as can be obtained from the ordinary stock of the combine. At 79, the return on the money is £5 1s. 3d. In this connection, investment may be interested to hear that several thousand Globe Telegraph & Trust ordinary shares have recently come on offer at 38s. As is commonly known, the Globe Telegraph & Trust holds a very substantial interest in Cable & Wireless; it also has extensive assets in other undertakings connected with the telegraph industry. Oriental Telephones at 45s. have put on 1s., and International "Tel. & Tel." are up a dollar.

British Electric Traction

The firmness of Home Railway stocks has made no difference to Thomas Tilling shares, but it served to strengthen British Electric Traction deferred. This has been changing hands on the basis of 1,075; the nominal price is 40 up, at 1,080. The stock would be more easily marketable were it to be divided into £1 units. It can be negotiated as units of £1 at the present time, and there is nothing to prevent a would-be shareholder from buying, say, £5 or £10 worth of stock. When it comes to selling, however, the holder of an oddment of this kind would be called upon to pay the stamp and fee, which, in the usual way, is a responsibility of the buyer. In its present shape, British Electric Traction deferred stock is a rich man's investment. Among investors there seems to be no general realisation of the fact that small amounts of the stock can be dealt in.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

ALLMÄNNA Svenska Elektriska Aktiebolaget.—" Means for the fine regulation of an alternating current voltage." 2834/42. March 17th, 1941. (558145.)

Birmingham Electric Furnaces, Ltd., and J. Harris.—" Furnaces for the heat treatment of materials." 1571. February 6th, 1942. (558094.) " Furnaces for the heat treatment of metals." 17211/43. February 6th, 1942. (Divided out of 558094.) (558110.)

F. J. G. Van Den Bosch, H. S. Molyneux-Ffennell, and Vacuum-Science Products, Ltd.—" Electron multipliers." 1966. February 13th, 1942. (558095.) " Electron multipliers." 15317/43. February 13th, 1942. (Divided out of 558095.) (558109.)

British Thomson-Houston Co., Ltd.—" Electromagnetic switches." 8313/42. June 18th, 1941. (558118.) " Mounting devices for electric discharge lamps." 8314/42. June 20th, 1941. (558119.) " Bonding of mica." 5902/42. May 2nd, 1941. (558136.) " Thermal switches." 8943/42. July 1st, 1941. (558205.) " Fluorescent materials." 9884/42. July 18th, 1941. (558213.) " Electric lamp socket." 10255/42. July 24th, 1941. (558217.)

Burndept, Ltd., and R. P. Richardson.—" Construction of electric dry cells." 9424. July 7th, 1942. (558207.)

Carr Fastener Co., Ltd. (United-Carr Fastener Corporation).—" Electrical connectors." 8587. June 23rd, 1942. (558199.)

Carr Fastener Co., Ltd., and G. Wagstaff.—" Holders for thermionic valves and other electrical devices." 6787. May 19th, 1942. (558114.)

Crown Cork & Seal Co., Inc.—" Method of and apparatus for electro-plating sheet metal." 8391/42. December 24th, 1941. (558130.)

R. A. Darge.—" Apparatus for stripping insulation from insulated wire." 8327. June 17th, 1942. (558121.)

E. D. Dennis.—" Electric vehicular head and other lamps for emitting diffused light." Cognate applications 2875/43 and 11705/42. June 19th, 1942. (Divided out of 558062.) (558179.)

Ford Motor Co., Ltd.—" Electrical apparatus and method of construction thereof." 7788/42. March 14th, 1941. (558222.)

J. W. H. Harvey, and Plessey Co., Ltd.—" Detachable electrical connections." 8081. June 12th, 1942. (558102.) " Coupling members for electrical conductors." 8082. June 12th, 1942. (558103.)

Lodge-Cottrell, Ltd., and L. Lodge.—" Apparatus for the electrical precipitation of suspended particles from gaseous fluids." 11043. August 7th, 1942. (558171.)

P. A. H. Mossay.—" Construction of AC dynamo-electric machines." 11167. August 10th, 1942. (558172.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken).—" Velocity modulated electron discharge tubes." 1618. February 6th, 1942. (558143.)

Radio Corporation of America.—" Reflection reducing layers on glass." Cognate applications 3453/42 and 3454/42. March 1st, 1941. (558098.)

Ransomes, Sims & Jefferies, Ltd., D. P. Ransome and A. H. Clark.—" Control gear for electric trucks, vehicles and cranes." 8044. June 12th, 1942. (558139.)

Siemens Bros. & Co., Ltd., and G. H. Foot.—" Electric signalling systems." 8287. June 17th, 1942. (558116.)

Soc. Suisse d'Electricité et de Traction.—" Electric signalling plants for vehicle traffic." 15983/41. December 11th, 1940. (558142.)

Standard Telephones & Cables, Ltd., and A. J. Maddock.—" Electrical contact arrangements." 8477. June 19th, 1942. (558169.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and D. M. Ambrose.—" Electrical relaxation oscillators." 8438. June 19th, 1942. (558163.)

G. Turnock, Ltd., and E. D. Jackson.—" Adaptor fittings for electric light and other fittings." 8786. June 26th, 1942. (558200.)

Amended Specifications Published

544972. Express Lift Co., Ltd., and another.—" Driving arrangements for lifts."

549714. Telephone Manufacturing Co., Ltd., and another.—" Telephone switching and exchange systems and apparatus."

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the following British Trade Marks. Objections may be entered within a month from January 5th.

SIMPEM. No. 625162, Class 9. Electric holders, being parts of electric welding apparatus. —Cammell Laird & Co., Ltd., New Chester Road, Birkenhead.

ULTRIC. No. 625271, Class 9. Wireless aerials, radio and television apparatus and parts thereof (not included in other classes); current amplifiers, convertors, high frequency apparatus (not included in other classes), wave meters, telephone receivers, loud speakers, acoustic conduits, measuring and testing instruments for electrical purposes, fire and burglar alarms, transformers, bells, distribution boards, electrically operated door openers, cut-outs, relays, soldering irons and automatic temperature regulators.—Ultra Electric, Ltd., Ultra Works, Western Avenue, Acton, London, W.3.

Designs. Nos. 625331-3, Class 9. Electrical apparatus (not included in other classes), and scientific apparatus.—Electro Methods, Ltd., 112, Brent Street, London, N.W.4.

INFRALASTIC. No. 624804, Class 17. Insulating varnish and insulating materials.—R. J. Hamer & Sons, Ltd., 2, Miles Road, Mitcham, Surrey.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—NEW SOUTH WALES.—January 20th. Sydney County Council. 11-kV metal-clad switching equipment for Camperdown and Mascot substations. Spec. 643 (£1).

January 26th. State Railways. Two 1,500-kW automatically controlled rectifier units. Spec. 1105.

COMMONWEALTH. — P.M.G.'s Department. January 27th. Switchboard parts, Sch. C. 4290. Telephone parts and accessories, Sch. C. 4286. February 8th. Long line equipment maintenance parts, Sch. C. 4292.

Orders Placed

Glasgow.—Municipal Transport Committee. Accepted. Scrub blocks.—William Gray & Co. and Carborundum Co. Carbon brushes.—Morgan Crucible Co. and Le Carbone. Asbestos-covered wire.—London Electric Wire Co. and Smiths.

Liverpool.—Electric Power and Lighting Committee. Recommended. Modifications, turbine evaporator plant, No. 5 turbo-alternator set, Clarence Dock power station (£941).—Metropolitan-Vickers.

London. — BATTERSEA. — Electricity Committee. Accepted. Fittings for wartime street lighting (£1,453).—G.E.C.

SOUTHWARK. — Electricity Committee. Accepted. Cables for twelve months.—Scottish Cables.

Manchester.—Health Committee. Accepted. Installation of radio equipment at Abergele children's sanatorium.—G.E.C.

Electricity Committee. Renewal of coal shutes, grit pipes and ash hopper chutes, Barton power station.—Dilworth & Carr; Brightside Foundry & Engineering Co.; Simon-Carves. Steel balls for coal pulverising plant.—Hadfields.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alsager.—Public offices, Lawton Road; H. V. Lynam, surveyor, Council Offices.

Ashbourne.—Town Hall for U.D.C.; D. Powell, surveyor, Council Offices, Compton Street.

Ashton-in-Makerfield.—Swimming baths; A. K. Dennis, surveyor, Council Offices, Bryn Road.

Birmingham.—Extensions to Yardley Sanatorium (£22,679) and Selly Oak Hospital (£62,000), and hostel, Tennyson Road, Small Heath; city engineer.

Bolton.—Two experimental houses; housing director.

Bootle.—Warehouse extension, 240, Hawthorne Road; Wm. Ross, Ltd.

Bournemouth.—Development of part of Muscliffe estate; B. T. Rodd.

Bradford.—Three large and two small kitchens, and remodelling of Green Lane cooking depot; J. T. Castle, city architect, Town Hall.

Brighouse.—Additions, mills, Briggate; T. Sugden & Son, Ltd., corn millers, Brighouse Mills.

Bury.—Children's home; J. Chadwick, borough engineer, Municipal Offices, 28, Bank Street.

Bute.—Public school, Rothesay; county clerk, Rothesay.

Cheshire.—Two classrooms as extensions to County High School for Girls, Macclesfield; E. M. Parkes, county architect, The Castle, Chester.

Coventry.—Experimental houses; Universal Housing Co., Ltd., Bury Lane, Rickmansworth.

Edinburgh.—School dining hall and kitchen accommodation at Bruntsfield House (heating and electrical installations); city architect, City Chambers.

Essex.—Central kitchen, Dagenham (£2,668); county architect.

Glasgow.—Canteen, Polmadie Road; Acme Tea Chest Co., Ltd.

Keighley.—Sewage disposal works; E. J. Felgate, borough architect, College Street.

Lancashire.—Wartime nursery, Propps Hall Farm estate, Failsworth; L. Evans, county architect, County Buildings, Fishergate Hill, Preston.

Lancaster—Welfare centre for Women's Welfare Committee; F. Hill, city surveyor, Town Hall.

London.—DEPTFORD.—Nursery, Clyde Street (£2,152); Walker (Tooting), Ltd.

SOUTHWARK.—Extensions, Lavington Street baths (£1,257); G. Parker & Sons, Ltd.

Manchester.—Renewal of wiring, replacement of fittings of electrical installations, etc., in wards at Baguley Sanatorium (£1,270); G. Noel Hill, city architect, Albert Square, Manchester, 2.

Newcastle-under-Lyme. — Cinema, Merrial Street; Gaumont British Cinematograph Co., Film House, Wardour Street, Regent Street, London, W.1.

Premises on site of Thistleberry House; Bent's Brewery Co., The Brewery, Stone, Staffs.

Rochdale.—Additions, mills; Henry Tattersall, Ltd., contractors, 272, Spotland Bridge.

Rotherham.—Canteen, Grange Mill Lane; A. Shardlow & Co., Ltd.

Rowley Regis.—Kitchen, Beech Road School, Blackheath, for Rowley Regis Education Committee; J. Harper & Son (Blackheath), Ltd., builders, Blackheath, Birmingham.

Sheffield.—Nurseries, Beck Road and Shirecliffe (£4,394); M. J. Gleeson, Ltd.

South Shields.—Two central kitchens and sculleries at schools; acting borough engineer.

Sunderland. — Partial reconstruction of Hendon Valley Road School; education architect, Education Offices.

Swindon.—Welding shop, Avenue Road; Deller & Son.

Wallasey.—Partial reinstatement of Earlston House (£1,985); borough engineer.

West Hartlepool. — School meals hut, St. Joseph's; borough engineer.

Wolverhampton.—Youth centre, Low Hill; secretary, Y.W.C.A. (Midland Division), 5, Victoria Square, Birmingham, 5.

Extensions to Woodlands Nursery (£1,100) for Maternity and Child Welfare Committee; W. M. Law, borough engineer, Town Hall.

Worcestershire.—Dining hall, Finstall Council School; H. Rowe & Son, county architects, 38, Foregate Street, Worcester.

Forthcoming Events

Institution of Electrical Engineers.—Monday, January 24th, 5.30 p.m. Informal discussion on "Industrial Applications of Radio-Frequency Methods of Heating," to be opened by Mr. N. R. Bligh.

Wireless Section.—Tuesday, January 18th, 5.30 p.m. Discussion on "Comparative Merits of Different Types of Directive Aerials for Communications," to be opened by Mr. J. A. Smale.

Measurements Section.—Friday, January 21st, 5.30 p.m. "A New Electronic Stabiliser and Regulator for DC Voltages," by Mr. A. Glynne.

West Wales (Swansea) Sub-Centre.—Saturday, January 15th, 3 p.m.. Guildhall, Swansea. "Air-Blast Circuit-Breakers," by Mr. A. R. Blandford.

North-Eastern Centre.—Monday, January 17th, 6.15 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. "Standardisation of Single-circuit Overhead Lines up to 33kV in Great Britain," by Messrs. H. Willot Taylor and K. L. May.

North Midland Centre.—Tuesday, January 18th, 6 p.m. Great Northern Hotel, Wellington Street, Leeds. "Bonded Deposits on Economiser Heating Surfaces," by Messrs. J. R. Rylands and J. R. Jenkinson.

Mersey & North Wales (Liverpool) Centre.—Wednesday, January 19th, 6 p.m. Municipal Annexe, Dale Street. "Electric Lamp Manufacture and Development," by Mr. A. L. Randall.

North-Western Centre.—Saturday, January 22nd, 2.30 p.m. Engineers' Club, Manchester. "Economic Rating of Motors and Transformers" and "Economic Flux Density in Large Supply Transformers," by Mr. D. J. Bolton, M.Sc.

East Midland Sub-Centre.—Wednesday, January 26th, 2.30 p.m. Loughborough College. "Protection of Structures Against Lightning," by Mr. J. F. Shipley.

North Midland Students' Section.—Saturday, January 15th, 2.30 p.m. Griffin Hotel, Leeds. "Recording of Disturbances on Electrical Supply Systems," by Mr. W. T. J. Atkins, B.Sc.

London Students' Section.—Monday, January 17th, 7 p.m. Problems Night.

North-Western Students' Section.—Thursday, January 20th, 7 p.m. Gas Showrooms, Chester Road, Stretford. Film evening.

Bristol Students' Section.—Friday, January 21st, 7.15 p.m. Pump Room, Bath. "Some Notes on Lightning Conductors and Earthing Systems," by Mr. H. W. Brown.

South Midland Students' Section.—Wednesday, January 26th. "Electrical Engineering Research," by Mr. H. W. H. Warren, M.Sc.

Junior Institution of Engineers.—Friday, January 14th, 6.15 p.m. 39, Victoria Street, London, S.W.1. "Tidal Power," by Mr. R. H. Abell, M.I.E.E.

Sheffield Section.—Saturday, January 15th, 2.30 p.m. Central Library, Surrey Street. "Synchrophone as an Aid to Post-War Training," by Mr. N. Sandor.

Institution of Electronics.—Saturday, January 15th, 3 p.m. Royal Society of Arts, John Adam Street, Adelphi, W.C.2. "Electron Diffraction and Surface Structure," by Prof. G. I. Finch.

Illuminating Engineering Society.—Tuesday, January 18th, 5.30 p.m. Joint meeting with Royal Institute of British Architects at 66, Portland Place, London, W.1. Discussion on "The Place of Science in the Art of Lighting," to be opened by Mr. A. MacDonald and Mr. R. O. Ackerley.

Bath and Bristol Centre.—Monday, January 17th, 7 p.m. Grand Hotel, Broad Street, Bristol. "Application of Low-Pressure Fluorescent Lamps," by Mr. W. R. Stevens (G.E.C. Research Laboratories).

Birmingham Centre.—Friday, January 28th, 6 p.m. Imperial Hotel. "Electric Lighting—a Contractor's Viewpoint," by Mr. J. Ashmore.

Institute of Fuel. — *London.* — Thursday, January 20th, 2.30 p.m. Institution of Mechanical Engineers, Storey's Gate. "Buying Coal — To-day and To-morrow," by Mr. J. Roberts.

Glasgow.—Friday, January 21st, 5.45 p.m. Royal Technical College. Meeting to inaugurate new Section. Address by Dr. E. W. Smith on "Education in the Fuel Industries."

Institution of Mechanical Engineers.—Friday, January 21st, 5.30 p.m. Informal discussion on "Future Possibilities of Diesel Engine Manufacture," to be introduced by Mr. W. S. Burn.

North East Coast Institution of Engineers & Shipbuilders.—Friday, January 21st, 6 p.m. Mining Institute, Newcastle-upon-Tyne. "Recent Welding Developments in British Merchant Shipbuilding," by Mr. R. B. Shepheard.

Association of Mining, Electrical and Mechanical Engineers.—*South Wales Branch.*—Saturday, January 22nd. Cardiff. "Some Aspects of Colliery Winding Practice," by Mr. R. W. Worrall, A.M.I.E.E.

Yorkshire North-West Branch. — Saturday, January 22nd, 3 p.m. Hotel Metropole, Leeds. "Pyrotenax Cables," by Mr. Cameron.